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OF THE

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2. The Public Accounts of Canada, for the fiscal year ended 31st March, 1914. Presented by Hon. Mr. White, February 9, 1915 .. .. ..*Printed for distribution and sessional papers.*

3. Estimates of sums required for the service of the Dominion for the year ending on 31st March, 1916. Presented by Hon. Mr. White, February 8, 1915.
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5*a*. Further Supplementary Estimates for year ending 31st March, 1916. Presented by Hon. Mr. White, March 31, 1915.. .. ..*Printed for distribution and sessional papers.*

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7. Report on certified cheques, dividends, unclaimed balances and drafts or bills of exchange remaining unpaid in Chartered Banks of the Dominion of Canada, forfive years and upwards prior to 31st December, 1913. Presented by Hon. Mr. White, April 10, 1915.
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8. Report of Superintendent of Insurance for year 1914. Presented by Hon. Mr. White, 1915.
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9. Abstract of Statement of Insurance Companies in Canada for year ended 31st December, 1914. Presented by Hon. Mr. White, 1914.
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10. Report of the Department of Trade and Commerce for the fiscal year ended 31st March, 1914: Part I.—Canadian Trade. Presented by Sir George Foster, 8th February, 1915.
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10*b*. Report of the Department of Trade and Commerce for the fiscal year ended 31st March, 1914: Part III.—Canadian Trade with foreign countries (except France, Germany, the United Kingdom, and United States.) Presented by Sir George Foster, 8th February, 1915.. .. ..*Printed for distribution and sessional papers.*

10*c*. Report of the Department of Trade and Commerce, for the fiscal year ended 31st March, 1914, (Part IV, Miscellaneous Information.) Presented by Sir George Foster, March 27, 1915.. .. ..*Printed for distribution and sessional papers.*

10*d*. Report of the Board of Grain Commissioners for Canada. Presented by Sir George Foster, 1914... .. ..*Printed for distribution and sessional papers.*

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10*f*. Report of Trade and Commerce for fiscal year ended 31st March, 1914. (Part VII.—Trade of Foreign Countries, Treaties and Conventions.) Presented by Sir George Foster, 1915... .. ..*Printed for distribution and sessional papers.*

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15. Report of the Minister of Agriculture for the Dominion of Canada, for the year ended 31st March, 1914. Presented by Hon. Mr. Burrell, February 8, 1915.
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15*b*. Report of the Veterinary Director General for the year ending 31st March, 1915. Presented by Hon. Mr. Burrell, 1915.. .. ..*Printed for distribution and sessional papers.*

16. Report of the Director and Officers of the Experimental Farms for the years ending 31st March, 1914. Presented by Hon. Mr. Burrell, March 1, 1915.
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17. Criminal Statistics for the year ended 30th September, 1913. (Appendix to the Report of the Minister of Trade and Commerce for the year 1913.) Presented by Sir George Foster, 1915.. .. ..*Printed for distribution and sessional papers.*

18. Return of By-elections for the House of Commons of Canada, held during the year 1911. Presented by Hon. Mr. Speaker, March 12, 1915.
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19. Report of the Minister of Public Works on the works under his control for the fiscal year ended 31st March, 1914, Volume I. Presented by Hon. Mr. Rogers, February 8, 1915
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20. Annual Report of the Department of Railways and Canals, for the fiscal period from 1st April, 1913, to 31st March, 1914. Presented by Hon. Mr. Cochrane, March 12.
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20*a*. Canal Statistics for the season of navigation, 1914. Presented by Hon. Mr. Cochrane, 9th April, 1915.. .. ..*Printed for distribution and sessional papers.*

20*b*. Railway Statistics of the Dominion of Canada, for the year ended 30th June, 1914. Presented by Hon. Mr. Cochrane, March 12, 1915.
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20*d*. Telephone Statistics of the Dominion of Canada, for the year ended 30th June, 1914. Presented by Hon. Mr. Cochrane, March 17, 1915.
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23. Supplement to the Forty-seventh Annual Report of the Department of Marine and Fisheries for the fiscal year 1913-14—Steamboat Inspection Report. Presented by Hon. Mr. Hazen, March 3, 1915 .. ..*Printed for distribution and sessional papers.*

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25*c*. Report of progress of stream measurements for calendar year of 1914. Presented by Hon. Mr. Roche, 1914.. .. ..*Printed for distribution and sessional papers.*

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25*e*. Report on Bow River Water Power and Storage Investigations, seasons 1911-1912-1913. Presented by Hon. Mr. Burrell, 1915.. ..*Printed for distribution and sessional papers.*

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29*b*. Report of the work of the Public Archives for the year 1913. Presented, 1915.
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30. The Civil Service List of Canada, 1914. Presented by Hon. Mr. Coderre, 9th February, 1915.. .. ..*Printed for distribution and sessional papers.*

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32. Annual Report of the Department of Public Printing and Stationery for the year ended 31st March, 1914. Presented by Hon. Mr. Coderre, 6th April, 1915
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33. Report of the Secretary of State for External Affairs for the year ended 31st March, 1914. Presented by Sir Robert Borden, 18th February, 1915.
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34. Report of the Minister of Justice as to Penetentiaries of Canada, for the fiscal year ended 31st March, 1914. Presented, 1915.. .. .. ..*Printed for distribution and sessional papers.*

35. Report of the Militia Council for the Dominion of Canada, for the fiscal year ending 31st March, 1914. Presented by Hon. Mr. Hughes, 10th February, 1915.
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36. Report of the Department of Labour for the fiscal year ending 31st March, 1914. Presented by Hon. Mr. Crothers, 8th February, 1915.
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36a. Seventh Report of the Registrar of Boards of Conciliation and Investigation of the proceedings under "The Industrial Disputes Investigation Act, 1907," for the fiscal year ending 31st March, 1914. Presented by Hon. Mr. Crothers, 8th February, 1915.
Printed for distribution and sessional papers.

37. Tenth Annual Report of the Commissioners of the Transcontinental Railway, for the year ended 31st March, 1914. Presented by Hon. Mr. Cochrane, 8th February, 1915.
Printed for distribution and sessional papers.

37a. Interim Report of the Commissioners of the Transcontinental Railway, for the nine months ended 31st December, 1914. Presented by Hon. Mr. Cochrane, 15th February, 1915.. .. .. .

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45. Return to an Order of the House of the 20th April, 1914, for a copy of all letters, papers, tenders and other documents in regard to the purchase of any cars for the Intercolonial Railway during the years 1912 and 1913. Presented 9th February, 1915.—*Mr. Macdonald*.. .. .. .

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of convicts; dates of conviction; crime of which convicted; sentences passed; by whom sentenced; sentences commuted, and if so, to what. 3. For a return showing all persons in Canada, and each province, convicted during the above mentioned period of murder whose sentences have been mitigated, or who have received a free pardon, together with a statement of the offences of which they were severally convicted, with the name of convicts; dates of conviction; nature of offence; sentences; and extent of mitigation of sentences and dates. 4. For a return of instances, during the above mentioned period, in which appeal has been made on behalf of the persons convicted of capital offences to His Excellency, the Governor in Council, for the exercise of the Royal Prerogative of pardon, or mitigation of sentences, with the name of convicts; dates of conviction and place; crime of which convicted; sentences; dates of appeal; and the result. Presented 9th February, 1915.—*Mr. Wilson (Laval)*.. ..*Not printed.*

54. General Rules and Orders of the Exchequer Court of Canada made, respectively, on the 23rd September, 1914, and the 18th June, 1914. Presented by Hon. Mr. Coderre, 9th February, 1915.. .. .. .

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62. Return to an Order of the House of the 11th May, 1914, for a copy of all letters, telegrams, correspondence and memorials since the 1st day of November, 1911, relating to the post office at Johnstown, Richmond County, N.S., and to complaints against the present postmaster and recommendations for his dismissal. Presented 9th February, 1915.—*Mr. Kyte*.. .. ..*Not printed.*

63. Return to an Order of the House of the 20th April, 1914, for a copy of all papers, petitions, letters and telegrams concerning the change of site of the post office at St. Lazare Village, county of Bellechasse, Quebec. Presented 9th February, 1915.—*Mr. Lemieux.* ....*Not printed.*

64. Statement of Governor General's Warrants issued since the last Session of Parliament on account of 1914-15. Presented by Hon. Mr. White, 9th February, 1915.
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65. Statement of expenditure on account of "Miscellaneous Unforeseen Expenses," from the 18th August, 1914, to the 4th February, 1915, in accordance with the Appropriation Act of 1914. Presented by Hon. Mr. White, 9th February, 1915.. .. ..*Not printed.*

66. Statement of Superannuation and Retiring Allowances in the Civil Service during the year ending 31st December, 1914, showing name, rank, salary, service, allowance and cause of retirement of each person superannuated or retired, also whether vacancy is filled by promotion or by appointment, and salary of any new appointee. Presented by Hon. Mr. White, 9th February, 1915.. .. ..*Not printed.*

67. Statement of receipts and expenditures of the Ottawa Improvement Commission to 31st March, 1914. Presented by Hon. Mr. White, 9th February, 1915..... ..*Not printed.*

68. Statement of the affairs of the Royal Society of Canada, for the year ended 30th April, 1914. Presented by Hon. Mr. White, 9th February, 1915.. .. ..*Not printed.*

69. Account of the average number of men employed on the Dominion Police Force during each month of the year 1914, and of their pay and travelling expenses, pursuant to Chapter 92, Section 6, Subsection 2, of the Revised Statutes of Canada. Presented by Hon. Mr. Doherty, 10th February, 1915.. .. ..*Not printed.*

70. Return to an Order of the Senate, dated the 16th January, 1913, calling for copy of the plans, reports, soundings, and other germane information respecting the ports of Churchill and Fort Nelson, so far as the Department of Railways and Canals is concerned.—(*Senate*).. .. ..*Not printed.*

71. Return to an Order of the Senate, dated the 29th April, 1914, showing:—1. Titles of all books, pamphlets and other printed papers issued by the King's Printer during the year ending on the 31st of March, 1914. 2. The number of each of such books, pamphlets and papers printed during such year, and the number distributed, with the dates of distribution. 3. The number of pages in each. 4. The cost of each. 5. The authority for the printing and issuing of each of such books, pamphlets and papers.—(*Senate*).. .. ..*Not printed.*

72. Return to an Order of the Senate dated the 30th April, 1914, for the production of all proposals submitted to the Government for the construction of the Montreal, Ottawa and Georgian Bay Canal and all the correspondence relating thereto.—(*Senate*).
Not printed.

72*a*. Return to an Order of the House of the 11th February, 1915, for a copy of all petitions and memoranda from commercial bodies or other parties in relation to the immediate construction of the Georgian Bay Canal, and of all correspondence in connection with the same since 21st September, 1911. Presented 4th March, 1915.—*Sir Wilfrid Laurier.*
Not printed.

73. Copies of general orders promulgated to the militia for the period between 25th November, 1913, and 24th December, 1914.—(*Senate*).. .. ..*Not printed.*

74. Copy of correspondence respecting the control of the exportation of nickel. Presented by Sir Robert Borden, 11th February, 1915.. .. ..*Not printed.*

75. Memorandum respecting work of the Department of Militia and Defence—European War, 1914-15. Presented by Hon. Mr. Hughes, 11th February, 1915.. .. ..*Not printed.*

76. Return to an Order of the House of the 6th April, 1914, for a copy of all correspondence, letters, telegrams, complaints and documents of all kinds received by the Department of Trade and Commerce during the years 1913-14, with respect to the Pictou-Mulgrave-Cheticamp steamship route. Presented 11th February, 1915.—*Mr. Chisholm (Inverness).* .. ..*Not printed.*

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77. Return to an Order of the House of the 8th June, 1914, for a copy of all documents bearing on an application or applications made to the Superintendent General of Indian Affairs or the Department, on an amendment to the Indian Act to facilitate the sale of the Indian Reserve of Restigouche, Que., or on the acquiring otherwise of any portion or the whole of the said reserve for industrial or other purposes, and any answers given thereto. Presented 11th February, 1915.—*Mr. Marcil (Bonaventure).*
Not printed.

78. Return to an Order of the House of the 2nd February, 1914, for a return showing the names of the sailors who have been employed on the *Eureka* during the years 1910, 1911, 1912 and 1913. Presented 12th February, 1915.—*Mr. Boulay*. . . . . *Not printed.*

79. Return to an Order of the House of the 15th April, 1914, for a return showing the total bond issue of the Canadian Northern Railway Company and its affiliated companies; and the total cost to date of the construction of the lines of railways comprising the Canadian Northern Railway system, including terminals, sidings, etc. Presented 12th February, 1915.—*Mr. Murphy*. . . . . *Not printed.*

80. Return to an Order of the House of the 18th May, 1914, for a copy of all papers, documents, reports and evidence relative to the dismissal or proposed dismissal of W. A. Case of the Government Quarantine Service at Halifax, N.S. Presented 12th February, 1915.—*Mr. McLean (Halifax)* . . . . . *Not printed.*

81. Return to an Order of the House of the 26th February, 1914, for a return showing:—1. The freight rates charged during the years 1912 and 1913, on wheat from Canadian ports to ports in the United Kingdom by the Canadian Pacific Railway Company's Steamship Lines, the Allan Steamship Line and the Canadian Northern Railway Company's Steamship Lines. 2. The profits made by the freight boats of the said several lines which carried wheat alone or with other freight. Presented 12th February, 1915. —*Sir James Aikins*. . . . . *Not printed.*

82. Return to an Order of the House of the 16th February, 1914, for a copy of all reports, requests, petitions, memorials, letters, telegrams and other correspondence and documents relating to the removal, suspension or dismissal, by the management of the Intercolonial Railway, of Warren Carter and Frederick Avard, employees in the freight department of the Intercolonial Railway at Sackville, N.B.; and of all letters, telegrams and other correspondence in the Department of Railways and Canals, or in the railway offices at Moncton, or in any Department of Government, addressed to the Minister of Railways and Canals, or to any other member of the Government, or to any official of the Department of Railways and Canals, or of the Intercolonial Railway, by any person or persons in the county of Westmorland, N.B., in any manner relating to said employees and to the dispensing with their services, particularly of any letters sent to F. P. Brady, General Superintendent of the Intercolonial, by any party or parties in Sackville, N.B., or elsewhere, and of all replies to any such letters, correspondence or documents. Presented 12th February, 1915.—*Mr. Emmerson.*
Not printed.

83. Return to an Order of the House of the 23rd March, 1914, for a return showing:—1. What investigations and other work have been entrusted by the Government, or any Department thereof, to G. Howard Ferguson, member for the electoral division of the county of Grenville in the Legislative Assembly of the province of Ontario. 2. How much the said G. Howard Ferguson has been paid by the Government, or any Department thereof, for fees and disbursements since the 21st of September, 1911, and how much is still due and owing to him. 3. How much has been paid to the said G. Howard Ferguson by the Government or any Department thereof, since the 21st September, 1911, in connection with any other matter whatever. Presented 12th February, 1915.—*Mr. Proulx*. . . . . *Not printed.*

84. Further Supplementary Return to an Order of the House of the 28th April, 1913, for a return showing a list of all the newspapers in Canada in which advertisements have been inserted by the Government, or any minister, officer or department thereof, between 10th October, 1911, and the present date, together with a statement of the gross amount paid therefor between the above dates to each of said newspapers or to the proprietors of the same. Presented 12th February, 1915.—*Mr. Sinclair*. . . . . *Not printed.*

84*a*. Further Supplementary Return to an Order of the House of the 30th April, 1913, for a return showing a list of all the newspapers in Canada in which advertisements have been inserted by the Government, or any minister, officer or department thereof, between the 10th day of October, 1906, and 10th October, 1907, and between said dates in each of the years following up to the 10th October, 1911, together with a statement of the gross amount paid therefor for the years mentioned, to each of the said newspapers or the proprietors of the same. Presented 12th February, 1915.—*Mr. Thornton.*
Not printed.

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85. Partial Return to an Order of the House of the 4th March, 1914, for a return showing:—1. How many employees of the Federal Government of Canada, including all services and all departments, have been dismissed from 10th October, 1911, to the present date. 2. How many have resigned. 3. How many have deserted the service. 4. How many deserters have been punished. 5. How many new employees have been engaged or appointed by the present Government during the same period. Presented 12th February, 1915.—*Mr. Boivin*.. .. ..*Not printed.*

85*a*. Return to an Order of the House of the 4th March, 1914, for a return showing:—1. How many employees of the Federal Government of Canada, including all services and all departments, have been dismissed from 10th October, 1911, to the present date. 2. How many have resigned. 3. How many have deserted the service. 4. How many deserters have been punished. 5. How many new employees have been engaged or appointed by the present Government during the same period. Presented 4th March, 1915.—*Mr. Boivin*.. .. ..*Not printed.*

85*b*. Further Supplementary Return to an Order of the House of the 4th March, 1914, for a return showing:—1. How many employees of the Federal Government of Canada, including all services and all departments, have been dismissed from 10th October, 1911, to the present date. 2. How many have resigned. 3. How many have deserted the service. 4. How many deserters have been punished. 5. How many new employees have been engaged or appointed by the present Government during the same period. Presented 5th March, 1915.—*Mr. Boivin*.. .. ..*Not printed.*

85*c*. Further Supplementary Return to an Order of the House of the 4th March, 1914, for a return showing:—1. How many employees of the Federal Government of Canada, including all services and all departments, have been dismissed from 10th October, 1911, to the present date. 2. How many have resigned. 3. How many have deserted the service. 4. How many deserters have been punished. 5. How many new employees have been engaged or appointed by the present Government during the same period. Presented 12th March, 1915.—*Mr. Boivin*.. .. ..*Not printed.*

85*d*. Further Supplementary Return to an Order of the House of the 4th March, 1914, for a return showing:—1. How many employees of the Federal Government of Canada, including all services and all departments, have been dismissed from 10th October, 1911, to the present date. 2. How many have resigned. 3. How many have deserted the service. 4. How many deserters have been punished. 5. How many new employees have been engaged or appointed by the present Government during the same period. Presented 7th April, 1915.—*Mr. Boivin*.. .. ..*Not printed.*

86. Further Supplementary Return to an Order of the House of the 18th February, 1914, for a copy of all charges, complaints, memorials, correspondence and telegrams, not already produced, relating to officials in any department of the Government since 10th October, 1911, the number of officials dismissed, reports of investigations held in respect of such charges, items of expenditure and costs of each investigation, the names of persons appointed to office in the place of dismissed officials, and of all recommendations received in behalf of persons so appointed in the province of Prince Edward Island. Presented 12th February, 1915.—*Mr. Hughes (Kings, P.E.I.)*

Not printed.

87. Partial Return to an Order of the House of the 18th May, 1914, for a return showing in all cases in which Charles Seager, of Goderich, acted as Government Commissioner in the investigation of officials charged with partizanship, or other offences, from and including the year 1896 to the year 1900; and the names of all officials dismissed by reason of the reports of the said Charles Seager, the positions held by such officials, and when such dismissals took place; with a copy of the evidence taken in all such cases, together with the commissioners reports thereon, and also showing what fees were paid to the said Charles Seager for conducting such investigations. Presented 12th February, 1915.—*Mr. Clark (Bruce)*.. .. ..*Not printed.*

88. Return to an Order of the House of the 16th March, 1914, for a copy of all correspondence, letters, telegrams, complaints and of all other documents in any way referring to the operation of the salmon hatchery at North East Margaree, and the fish pond at Margaree Harbour from 1911 to date. Presented 15th February, 1915.—*Mr. Chisholm (Inverness)*.. .. ..*Not printed.*

89. Return to an Address to His Royal Highness the Governor General of the 11th May, 1914, for a copy of all letters, telegrams, Orders in Council, contracts, tenders, papers and other documents in possession of the Department of Public Works, and of the Department of Militia and Defence, relating to the construction of an armoury at Amherst, N.S. Presented 15th February, 1915.—*Mr. Sinclair*... .. ..*Not printed.*

90. Letters of the Honourable Louis P. Pelletier, M.P., and the Honourable Wilfrid B. Nantel, M.P., resigning their positions as Postmaster General and Minister of Inland Revenue, respectively, and letters of the Prime Minister in acknowledgment thereof. Presented by Sir Robert Borden, 15th February, 1915.. .. ..*Not printd.*

CONTENTS OF VOLUME 28—*Continued.*

91. Report of Board of Officers on boots supplied to the Canadian Expeditionary Force. Presented by Hon. Mr. Hughes, 15th February, 1915.. .. ..*Not printed.*

92. Regulations under "The Destructive Insect and Pest Act." Presented by Hon. Mr. Burrell, 16th February, 1915.. .. ..*Not printed.*

93. Report on "The Agricultural Instruction Act," 1913-14, pursuant to Section 8 of the above named Act. Presented by Hon. Mr. Burrell, 16th February, 1915.
Printed for sessional papers only.

93*a*. Supplementary Return to an Address to His Royal Highness the Governor General of the 9th February, 1914, for a copy of all arrangements made between the Government and the various provinces under the Agricultural Instruction Act. Presented 19th February, 1915.—*Sir Wilfrid Laurier*.. .. ..*Not printed.*

93*b*. Return to an Order of the House of the 20th April, 1914, for a copy of all documents, correspondence, letters, petitions, reports, etc., exchanged between Dr. C. C. James, Mr. J. C. Chapais and each of the Provincial Ministers of Agriculture, in connection with the distribution and the administration of the federal subsidy granted to the provinces for agricultural purposes since the granting of same. Presented 23rd February, 1915. —*Mr. Lapointe (Kamouraska)*.. .. ..*Not printed.*

94. Return to an Order of the House of the 11th February, 1914, for a copy of all telegrams, correspondence, instructions, recommendations, and other documents that passed between the Shellfish Fishery Commission of 1913, and the Department of Marine and Fisheries, from the date of the appointment of said Commission to 31st December, 1913, excluding such documents as have been printed in the published report of said Commission. Presented 16th February, 1915.—*Mr. Sinclair*.. .. ..*Not printed.*

95. Return to an Order of the House of the 16th March, 1914, for a copy of all correspondence, tenders, telegrams, complaints and of all other documents in any way referring to the collecting of spawn for the Margaree Lobster Hatchery during the years 1911-12, 1912-13 and 1913-14. Presented 16th February, 1915.—*Mr. Chisholm (Inverness)*.
Not printed.

96. Return to an Order of the House of the 10th February, 1915, for a return showing the amount of coal imported into Alberta, Saskatchewan and Manitoba, respectively, from the United States during the year 1914; also the amount of duty collected in each of the said provinces during the same year. Presented 16th February, 1915.—*Mr. Buchanan*.. .. ..*Not printed.*

97. Copy of the Eighth Joint Report of the Commissioners for the Demarcation of the Meridian of the 141st Degree of West Lngitude. Presented by Hon. Mr. Roche, 18th February, 1915.. .. ..*Not printed.*

98. Return to an Order of the House of the 20th April, 1914, for a copy of the agreement between the Government of Canada and the Canadian Pacific Railway Company at the time the special land grant was made whereby the Canadian Pacific Railway Company were enabled to get their land grant in one block for the purpose of establishing their present irrigation system east of Calgary, province of Alberta. Presented 18th February, 1915.—*Mr. Burnham*.. .. ..*Not printed.*

99. Return to an Order of the House of the 23rd March, 1914, for a copy of all letters, telegrams and other documents in connection with the sale of any timber on Parry Island, Parry Sound District, and of advertisements, agreements for purchase and any other documents connected with such sale or grant of timber to any person or persons. Presented 18th February, 1915.—*Mr. Arthurs*.. .. ..*Not rpinted.*

100. Return to an Order of the House of the 11th February, 1914, for a return showing reasons for the dismissal of Mr. Larivière, Dominion Lands Agent at Girouard; the date of his appointment and of dismissal and salary at time of dismissal; also the name of agent appointed in his place, with date of appointment and salary. Presented 18th February, 1915.—*Mr. Oliver*.. .. ..*Not printed.*

101. Annual Return respecting Trade Unions under Chapter 125, R.S.C., 1906. Presented by Hon. Mr. Coderre, 18th February, 1915.. .. ..*Not printed.*

102. A detailed statement of all bonds or securities registered in the Department of the Secretary of State of Canada, since last return (21st January, 1911) submitted to the Parliament of Canada under Section 32 of Chapter 19, of the Revised Statutes of Canada, 1906. Presented by Hon. Mr. Coderre, 18th February, 1915.. .. ..*Not printed.*

CONTENTS OF VOLUME 28—*Continued.*

103. Return to an Order of the House of the 9th February, 1914, for a copy of all petitions, memorials, letters, telegrams, papers, and documents received by any department of the Government of Canada, or any Minister of the Crown from any company, corporation, person or persons, requesting the removal of any customs duties upon wheat or wheat products entering Canada, or protesting against any diminution or removal of such custom's duties, and any replies thereto. Presented 18th February, 1915.—*Mr. Maclean (Halifax)*.. .. ..*Not printed.*

104. Return to an Order of the House of the 20th April, 1914, for a copy of all correspondence, letters, documents or other papers relating to the cancellation of the entry of R. Bannatyne for the northwest ¼ of section 24, township 35, range 18, west of the 2nd meridian. Presented 19th February, 1915.—*Mr. Neely*.. .. ..*Not printed.*

105. Return to an Order of the House of the 16th February, 1914, for a return showing the name of the postmaster of the Parish of St. Romuald, county of Lévis, who, it is said, was dismissed from office since September, 1911, the reasons for such dismissal, the nature of the complaints made against him, the names of the parties who made those complaints, together with a copy of all correspondence and telegrams relating thereto, the name of the inquiring commissioner, and report of investigation, if any, and of all evidence taken at the investigation, the names of those who recommended the successor, names of the parties by whom the Government was represented at such investigation, with a detailed statement of all the accounts paid or to be paid by any department in connection with the aforesaid dismissal and investigation, the names of the parties who received any money or filed their accounts in connection with said investigation, and the amount awarded to or claimed by each of them. Presented 19th February, 1915.—*Mr. Bourassa*... .. ..*Not printed.*

106. Return showing lands sold by the Canadian Pacific Railway Company during the year which ended on the 30th September, 1914. Presented by Hon. Mr. Roche, 19th February, 1915.. .. ..*Not printed.*

107. Return to an Order of the House of the 10th June, 1914, for a return showing:—1. The amount of money sent through the post offices in the past five years outside Canada from the following Cape Breton post offices: Glace Bay, Caledonia Mines, Dominion No. 4, New Aberdeen, Bridgeford, Old Bridgeford, Reserve Mines, Sydney, Whitney Pier, Ashby, North Sydney, Sydney Mines, Florence, Dominion No. 6, and Port Marrien. 2. What countries was such money transmitted to. Presented 22nd February, 1915.—*Mr. Carroll*.. .. ..*Not printed.*

108. Return to an Order of the House of the 15th February, 1915, for a copy of all correspondence, telegrams and other documents in connection with the removal from the customs service at Lethbridge, Alberta, of Brown Pipes and A. R. Gibbons. Presented 23rd February, 1915.—*Mr. Buchanan*.. .. ..*Not printed.*

109. Return to an Order of the House of the 15th February, 1915, for a return giving the names of all the transports hired since 1st August, 1914, for the conveyance of troops, horses, stores and material to England, the name of each vessel owner, broker or other person through whom the vessel was chartered, the tonnage of each vessel, speed, rate paid per ton per week or month, minimum time for which engaged, date of agreement, date at which pay commenced, date at which pay ceased, and the total sum paid by the Government for hire and other charges. Presented 23rd February, 1915.—*Mr. Murphy*.. .. ..*Not printed.*

110. Return to an Order of the House of the 15th February, 1915, for a return showing:—1. How many transport wagons were purchased for the Second and Third Contingents? 2. From whom they were purchased, and the name of each person or firm? 3. How many were purchased from each? 4. What was the price paid per wagon? 5. If any tenders were asked? 6. If any tenders were received that were not accepted? 7. If so, what was the price tendered at? Presented 23rd February, 1915.—*Mr. Nesbitt.*
Not printed.

111. Return to an Order of the House of the 11th February, 1915, for a return showing:—1. How many persons have been made prisoners of war since the declaration of war between the Allies, Germany and Austria? 2. Where they have been kept captive? 3. What is the name of each place of detention, and the name of the officer in charge of such place of detention? Presented 23rd February, 1915.—*Mr. Wilson (Laval).*
Not printed

111*a*. Return to an Order of the House of the 19th February, 1915, for a statement in detail of: The number of prisoners of war in this country; the number under parole; the number held in detention camps; the number of detention camps, where situated, how accessible, and the number of prisoners in each. The amount of cost to Canada in each of these camps, respectively, for subsistence, pay, clothing, transportation and supervision; the nature of work done by prisoners, and the total value of same to date. Presented 1st April, 1915.—*Mr. Clark (Red Deer)*.. .. ..*Not printed.*

CONTENTS OF VOLUME 28—*Continued.*

112. Return to an Order of the House of the 15th February, 1915, for a copy of all letters, telegrams, minutes of investigation and other documents relating to the dismissal of James Brennan, fireman Intercolonial Railway at Stellarton. Presented 25th February, 1915.—*Mr. Macdonald*.. .. .. .

CONTENTS OF VOLUME 28—*Continued.*

120. Return to an Order of the House of the 15th February, 1915, for a return showing whether any exportations of food-stuffs have been made since 1st August last, to European countries, other than the United Kingdom, France and Belgium, and if so, their nature and what countries. Presented 25th February, 1915.—*Mr. Cockshutt.*
Not printed.

121. Return to an Order of the House of the 11th February, 1915, for a copy of the petition, papers, documents and letters in connection with the incorporation of the Dominion Trust Company, incorporated by Special Act of the Parliament of Canada in 1912, being Chapter 89 of 2 George V. Presented 25th February, 1915.—*Mr. Proulx.*
Not printed.

121*a*. Return to an Order of the House of the 11th February, 1915, for a copy of all the correspondence exchanged between the Department of Justice and the Government of the province of British Columbia, or any of its members, with regard to a certain Act passed by the Legislature of the said province in 1913, being Chapter 89 of 2 George V., entitled: "An Act respecting the Dominion Trust Company." Presented 4th March, 1915.—*Mr. Proulx*.. .. .. .

CONTENTS OF VOLUME 28—*Continued.*

128*b*. Return of Orders in Council which have been published in the *Canada Gazette* and in the British Columbia *Gazette*, between 11th April, 1914, and 10th December, 1914, in accordance with provisions of Subsection (*d*) of Section 38 of the regulations for the survey, administration, disposal and management of Dominion Lands within the 40-mile railway belt in the province of British Columbia. Presented by Hon. Mr. Roche, 12th March, 1915.. . . . . *Not printed.*

128*c*. Orders in Council which have been published in the *Canada Gazette* and in the *British Columbia Gazette*, between 1st December, 1913, and the 15th January, 1915, in accordance with the provisions of Subsection (*d*) of Section 38 of the Regulations for the survey, administration, disposal and management of Dominion Lands within the 40-mile railway belt in the province of British Columbia.—(*Senate*) . . . . . *Not printed.*

129. Orders in Council passed between 1st December, 1913 and 15th January, 1915, approving of regulations and forms prescribed in accordance with the provisions of Section 57 of the Irrigation Act, Chapter 61, Revised Statutes of Canada, 1906, as amended by Chapter 38, 7-8 Edward VII.—(*Senate*). . . . . *Not printed.*

130. Return to an Order of the House of the 25th February, 1915, for a return showing whether the Government purchased from the Canada Cycle and Motor Company tires for motor trucks for the first Canadian Contingent and, if so, the price paid per set and the number purchased; also whether the Government have obtained prices for tires for motor trucks for the second contingent and, if so, the prices per set so obtained. Presented 3rd March, 1915.—*Mr. Gauvreau*. . . . . *Not printed.*

131. Return to an Order of the House of the 15th February, 1915, for a copy of all correspondence, telegrams and other documents in connection with the appointment of A. H. McKeown to the immigration service at Lethbridge, Alberta. Presented 3rd March, 1915.—*Mr. Buchanan*. . . . . *Not printed.*

132. Return to an Order of the House of the 15th February, 1915, for a copy of all correspondence, telegrams and other documents in connection with the removal from office of A. E. Humphries, Inspector of Immigration at Lethbridge, Alberta. Presented 3rd March, 1915.—*Mr. Buchanan*. . . . . *Not printed.*

133. Return to an Order of the House of the 3rd June, 1914, for a return showing:—1. Who secured the mail contract between Armagh Station and Mailloux, county of Bellechasse, Que.? 2. How many tenders were received? 3. The names of the tenderers, and the amount of each tender? Presented 3rd March, 1915.—*Mr. Lemieux*. . . . . *Not printed.*

134. Return to an Order of the House of the 6th April, 1914, for a copy of all letters, telegrams, correspondence, complaints, and documents of all kinds in any way connected with the asking for tenders for the mail route between Low Point and Creignish Station during the years 1913-14. Presented 3rd March, 1915.—*Mr. Chisholm (Inverness)*. *Not printed.*

135. Return to an Order of the House of the 6th April, 1914, for a copy of all letters, telegrams and other documents relative to the mail contract between New Ross and Vaughans post office, Waterville, province of Nova Scotia. Presented 3rd March, 1915. —*Mr. Macdonald*. . . . . *Not printed.*

136. Return to an Order of the House of the 18th May, 1914, for a copy of all correspondence, telegrams, letters and documents of all kinds in possession of the Post Office Department received since 1913, up to the present date in any way referring to the mail contract from Mabou to Wycocomagh. Presented 3rd March, 1915.—*Mr. Chisholm (Inverness)* . . . . . *Not printed*

137. Return to an Order of the House of the 25th February, 1915, for a return showing:—1. The amount of money collected by sub-collectors of customs at Edmundston, N.B., at Clair, N.B., at St. Leonards, N.B., and at Green River, N.B., each and every year for the last five fiscal years. 2. The salaries paid in connection with each of said ports each year. Presented 3rd March, 1915.—*Mr. Michaud*. . . . . *Not printed.*

138. Return to an Order of the House of the 10th February, 1915, for a return showing how much money has been spent amongst the merchants of the city of Medicine Hat for Government relief, to whom the payments were made and the total amount in each case. Presented 4th March, 1915.—*Mr. Buchanan*. . . . . *Not printed.*

139. Return to an Order of the House of the 2nd February, 1914, for a copy of all letters, correspondence, papers and documents relating to the dismissal of the following persons from the below mentioned offices in Shelburne County, N.S.:—J. V. Smith, sub-collector of customs at Lower Woods Harbour; John H. Lyons, keeper of lightship, Barrington Passage; William L. Smith, lightkeeper, Baccaro; E. D. Smith, fishery overseer, Shag Harbour; J. A. Orechia, harbour master, Woods Harbour; J. C. Morrison, harbour master, Shelburne; and Albert Mahaney, postmaster at Churchover. Presented 4th March, 1915.—*Mr. Maclean (Halifax)*. . . . . *Not printed.*

CONTENTS OF VOLUME 28—*Continued.*

139*a*. Return to an Order of the House of the 24th February, 1915, for a copy of all letters, papers and documents relating to the dismissal of the following officers in Shelburne County, N.S.: Wm. L. Smith, lightkeeper, Baccaro, N.S.; J. A. Arechia, harbour master, Lower Wood Harbour, and J. C. Morrison, harbour master, Shelburne, N.S. Presented 16th March, 1915.—*Mr. Law*.. .. .. .

CONTENTS OF VOLUME 28—*Continued.*

150. Return to an Order of the House, of the 11th February, 1915, for a return showing the names and addresses of all persons in Antigonish County to whom the bounty under the Fenian Raid Volunteer Bounty Act has been paid; the names and addresses of all persons from said county whose applications have been rejected, and a list giving names and addresses of all applications from said county whose applications have not yet been disposed of. Presented 8th March, 1915.—*Mr. Chisholm (Antigonish).*
Not printed.

151. Return to an Order of the House, of the 3rd March, 1915, for a return showing:—1. Who were the different officers commissioned to the 17th Nova Scotia Regiment at Valcartier before they sailed for England? 2. Who are now the commissioned officers of said regiment. Presented 8th March, 1915.—*Mr. Macdonald*.. .. ..*Not printed.*

152. Return to an Order of the House, of the 9th February, 1915, for a copy of all accounts of the transfer of the storm signal at Shippigan, N.B., from its former position on land to the public wharf, showing the total cost of said transfer during the months of October and November in 1911. Presented 8th March, 1915.—*Mr. Turgeon.*
Not printed.

153. Return to an Order of the House, of the 4th May, 1914, for a copy of all correspondence, telegrams, petitions, including the signatures of such petitions, and all other documents and papers in the possession of the Department of Trade and Commerce, or the minister of said department, or in the possession of the Prime Minister, relating to any application made between 1st November, 1913, and date hereof by parties in Nova Scotia asking for Government assistance towards the transportation of fresh fish between ports in Nova Scotia and the United States. Presented 9th March, 1915.—*Mr. Sinclair.*
Not printed.

154. Statement of Mr. H. C. Crowell, staff correspondent of the Halifax *Chronicle*, and correspondence in connection with statements appearing in the press referring to alleged ill-treatment of the 17th Regiment of Nova Scotia, at Salisbury Plains. Presented by Sir Robert Borden, 9th March, 1915.. .. ..*Not printed.*

155. Return to an Order of the House, of the 3rd March, 1915, for a return showing:—1. The estimated cost of fitting up the works of the Canadian Car and Foundry Company, Limited, at Amherst, N.S., for military purposes. 2. The rent or other remuneration being paid, or will be paid, this company for the use of its buildings. 3. Who are to supply the military provisions, including food for men, coal for heating and cooking, and food and other supplies for horses quartered on these premises, and at what prices. 4. Whether it is true that forms for tendering for such military supplies could only be obtained from the office of the sitting member for Cumberland County, and in several cases forms of tender were refused to applicants. 5. Whether the Government is aware that in the case of the supplying of hay, as alleged, not only Liberals were not allowed to tender for same, but supporters of the Government were informed they would not secure any part of the contract, if any of the hay to be supplied was to be purchased from a Liberal. Presented 11th March, 1915.—*Mr. Copp*.. .. .. ..*Not printed.*

156. Return to an Address to His Royal Highness the Governor General, of the 1st March, 1915, for a copy of all correspondence of the Imperial authorities on the subject of loans from the Imperial Treasury to the Canadian Government. Presented 11th March, 1915.—*Mr. Maclean (Halifax)*.. .. ..*Not printed.*

157. Return to an Order of the House of the 3rd March, 1915, for a copy of all correspondence, recommendations, letters and telegrams relating to the appointment of H. W. Ingraham as Assistant Registrar of Alien Enemies at Sdyney, N.S., and to his dismissal from the said office. Presented 12th March, 1915.—*Mr. Kyte*.. .. ..*Not printed.*

158. Return to an Address to His Royal Highness the Governor General of the 11th February, 1915, for a copy of all correspondence relating to the purchase of, and payment by the Government for two submarines authorized by Order in Council dated the 7th August, 1914, and of any other Order or Orders in Council relating thereto; and also of all reports received by the Government or any department thereof referring to said submarines. Presented 12th March, 1915.—*Mr. Pugsley* .. ..*Printed for distribution only.*

158*a*. Supplementary Return to an Address to His Royal Highness the Governor General, of the 11th February, 1915, for a copy of all correspondence relating to the purchase of, and payment by the Government for two submarines authorized by Order in Council dated the 7th August, 1914, and of any other Order or Orders in Council relating thereto; and also of all reports received by the Government or any department thereof referring to said submarines. Presented 15th March, 1915.—*Mr. Pugsley.*
Printed for distribution only.

CONTENTS OF VOLUME 28—*Continued.*

158*b*. Further Supplementary Return to an Address to His Royal Highness the Governor General, of the 11th February, 1915, for a copy of all correspondence relating to the purchase of, and payment by the Government for two submarines authorized by Order in Council dated the 7th August, 1914, and of any other Order or Orders in Council relating thereto; and also of all reports received by the Government, or any department thereof, referring to said submarines. Presented 24th March, 1915.—*Mr. Pugsley.*
Printed for distribution only.

159. Return to an Order of the House of the 19th February, 1915, for a copy of all correspondence, telegrams, petitions, letters and all other documents in any way referring to the dismissal of Mr. Mallet, captain of the life-boat in the life-saving station at Cheticamp, and the appointment of his successor. Presented 12th March, 1915.—*Mr. Chisholm (Antigonish)*.. .. .. .

CONTENTS OF VOLUME 28—*Continued.*

170. Return to an Order of the House of the 11th February, 1915, for a copy of all petitions, letters, telegrams and correspondence regarding a proposed daily mail service between Lower South River and South Side Harbour, Antigonish County, and improved postal accommodation for the residents of the last-named district. Presented 17th March, 1915.—*Mr. Chisholm (Antigonish)*.. .. .. .

CONTENTS OF VOLUME 28—*Continued.*

180. Return to an Order of the House of the 8th March, 1915, for a return showing:—1. The number of customs officers employed at the customs port of Abercorn, Quebec, on 20th September, 1911. 2. The names of these officers. 3. The salary each one received. 4. The total amount of salaries paid the officers at this port. 5. The number of customs officers employed at the port of Abercorn at the present time. 6. The names of these officers. 7. The salary each one receives. 8. The total amount of salaries paid to the officers at this port. Presented 18th March, 1915.—*Mr. Kay*... ..*Not printed.*

181. Return to an Order of the House, of the 1st March, 1915, for a copy of all petitions, letters, communications and other documents relating to or bearing upon the dismissal of Leonard Hutchinson, chief keeper at Dorchester penintentiary. Presented 18th March, 1915.—*Mr. Copp*.. .. ..*Not printed.*

182. Return to an Order of the House of the 22nd February, 1915, for a copy of all letters, telegrams and papers generally concerning the proposed construction of a bridge to connect Isle Perrot with the mainland at Vaudreuil. Presented 18th March, 1915.—*Mr. Boyer*... .. ..*Not printed.*

182a. Return to an Order of the House of the 22nd February, 1915, for a copy of all letters, telegrams and papers generally concerning the proposed construction of a bridge between the Island of Montreal and the Mainland at Vaudreuil. Presented 18th March, 1915.—*Mr. Boyer* .. ..*Not printed.*

183. Return to an Order of the House of the 22nd February, 1915, for a return showing:—1. What properties have been acquired by the Government in the City of Regina since 21st September, 1911? 2. The descriptions of such properties by metes and bounds? 3. For what purposes such properties were acquired? 4. From whom such properties were purchased? 5. The total price and the price per foot paid for each property? 6. If any such property was acquired by expropriation, what tribunal determined the price to be paid for any property so expropriated? 7. The dates on which any such properties were acquired? Presented 18th March, 1915.—*Mr. Martin* (*Regina*).

184. Return to an Order of the House of the 19th February, 1915, for a copy of all letters, telegrams, memoranda, pay-lists, recommendations and any other documents whatsoever in any wise appertaining to the construction of a wharf at Lower Burlington, in the County of Hants. Presented 18th March, 1915.—*Mr. Chisholm* (*Inverness*).
Not printed.

185. Return to an Order of the House of the 24th February, 1915, for a copy of pay-rolls and all correspondence and vouchers in connection with the repairs to Jordan breakwater, Shelburne county, for which Leander McKenzie was contractor of works or foreman. Presented 18th March, 1915.—*Mr. Law* .. ..*Not printed.*

186. Return to an Order of the House of the 24th February, 1915, for a copy of all letters, telegrams, correspondence and pay-rolls in connection with repairs and extension of breakwater at Bluff Head, Yarmouth county, N.S., during year 1914. Presented 18th March, 1915.—*Mr. Law*.. .. ..*Not printed.*

187. Return to an Order of the House of the 22nd February, 1915, for a return showing the amounts expended by the Public Works Department in the County of Inverness each year from 1896 down to 1915. Presented 18th March, 1915.—*Mr. Chisholm (Inverness)*.. .. ..*Not printed.*

188. Return to an Order of the House of the 24th February, 1915, for a copy of all letters, telegrams, correspondence and pay-sheets in connection with the repairs and other work on the breakwater at Sandford, Yarmouth County, N.S., during the year 1914. Presented 18th March, 1915.—*Mr. Law*.. .. ..*Not printed.*

189. Return to an Order of the House of the 1st March, 1915, for a copy of all papers, letters, petitions and other documents relating to a mail contract with David D. Heard & Sons, between Whitby and Grand Trunk Railway station, or with one John Gimblet, Whitby. Presented 19th March, 1915.—*Mr. Pardee*.. .. ..*Not printed.*

190. Copies of Reports of the Committee of the Privy Council, approved by His Royal Highness the Governor General, relating to certain advances made to the Canadian Northern Railway Company and the Grand Trunk Pacific Railway Company, respectively, together with copies of agreements made between the said companies and His Majesty. Presented by Hon. Mr. White, 19th March, 1915.. .. ..*Not printed.*

191. Return to an Order of the House of the 11th February, 1915, for a copy of all tenders received by the Post Office Department for the mail service between Caraquet and Tracadie, Gloucester County, N.B., on the 15th day of January last, with the names of the tenderers, the respective amounts of the tenders, and the name of the new contractor. Presented 19th March, 1915.—*Mr. Turgeon*.. .. ..*Not printed.*

CONTENTS OF VOLUME 28—*Continued.*

192. Return to an Order of the House of the 8th March, 1915, for a return showing:—1. The fractional areas of homestead lands or otherwise in the province of Saskatchewan sold in the year 1914. 2. The name of the purchaser, and the price paid in each case. Presented 22nd March, 1915.—*Mr. Martin (Regina)*.. .. ..*Not printed.*

193. Return to an Order of the House of the 25th February, 1915, for a return showing, in reference to the answer to question No. 6 of 9th February, and answered 15th February as per page 161 unrevised *Hansard*, the cost of furnishing the Government offices in each of the said buildings. Presented 22nd March, 1915.—*Mr. Turriff.*
Not printed.

194. Return to an Order of the House of the 1st March, 1915, for a return showing the amount of railway subsidies paid in the county of Inverness since 1896, to date, and the dates on which such subsidies were paid. Presented 22nd March, 1915.—*Mr. Chisholm (Inverness)*.. .. ..*Not printed.*

195. Return to an Order of the House of the 1st March, 1915, for a copy of all letters, papers, telegrams and other documents relating to the purchase or lease of the railway from New Glasgow to Thorburn, in the county of Pictou, known as the Vale Railway, from the Acadia Coal Company, since January, 1911, to date. Presented 22nd March, 1915. —*Mr. Macdonald*.. .. ..*Not printed.*

196. Return to an Order of the House of the 1st March, 1915, for a copy of all papers, letters, telegrams, correspondence, contracts, etc., in connection with the sale of the hay grown or the lease of certain tracts of land belonging to the Intercolonial Railway, upon which hay is grown, and which are contiguous to the properties of Charles Lavoie, Cléophas Leclerc and Joseph Parent of the Parish of Bic, county of Rimouski. Presented 22nd March, 1915.—*Mr. Lapointe (Kamouraska)*.. .. ..*Not printed.*

197. Return to an Order of the House of the 3rd March, 1915, for a copy of all letters, papers, telegrams, evidence taken at investigations, reports and all other documents relating to the suspension or other action in regard to the charge of drunkeness against Newton Hopper, conductor on the Intercolonial Railway, and to his subsequent reinstatement. Presented 22nd March, 1915.—*Mr. Macdonald*.. .. ..*Not printed.*

198. Return to an Order of the House of the 1st March, 1915, for a copy of all letters, telegrams and other papers relating to the dismissal of Bruce Wiswell, as sectionman on the Intercolonial Railway at Stellarton, Nova Scotia. Presented 22nd March, 1915.— *Mr. Macdonald*.. .. ..*Not printed.*

199. Return to an Order of the House of the 22nd February, 1915, for a return showing:— 1. The inward tonnage freight, and also the outward tonnage freight respectively, at Loggieville station of the Intercolonial Railway for each month of 1914, and also for the month of January, 1915. 2. The inward tonnage freight, and the outward tonnage freight at Chatham station, on the Intercolonial Railway for each month of 1914, and also for the month of January, 1915. 3. The inward tonnage freight, and the outward tonnage freight at Newcastle station on the Intercolonial Railway for each month of 1914, and also for the month of January, 1915. 4. The local and through passenger traffic to and through each of the above stations, respectively, during each of the months above mentioned. Presented 22nd March, 1915.—*Mr. Loggie.*
Not printed.

200. Return to an Order of the House of the 15th February, 1915, for a copy of all letters, telegrams and correspondence had by Margaret Lynch, or any person representing her, with reference to the expropriation of certain land beolnging to the said Margaret Lynch in the city of Fredericton, province of New Brunswick, by the Intercolonial Railway, and also of all letters, telegrams and correspondence had with F. P. Gutelius or any other official of the Intercolonial Railway with reference thereto. Presented 22nd March, 1915.—*Mr. Carvell*.. .. ..*Not printed.*

201. Return to an Order of the House of the 3rd March, 1915, for a copy of all documents bearing on the payment made to C. R. Scoles, New Carlisle, Quebec, in July, 1914, of balance of subsidy voted to the Atlantic and Lake Superior Railway on the recommendation of the Financial Comptroller. Presented 22nd March, 1915.—*Mr. Marcil.*
Not printed.

202. Return to an Order of the House of the 1st March, 1915, for a copy of all letters, telegrams, correspondence and reports relating to the purchase of the New Brunswick and Prince Edward Island Railway, extending from Sackville to Cape Tormentine, county of Westmorland. Presented 22nd March, 1915.—*Mr. Copp*.. .. ..*Not printed.*

203. Return to an Order of the House of the 1st March, 1915, for a copy of the tariff on flour shipments now in force on the Quebec, Oriental Railway and the Atlantic, Quebec and Western Railway. Presented 22nd March, 1915.—*Mr. Marcil*.. .. ..*Not printed.*

CONTENTS OF VOLUME 28—*Continued.*

204. Return to an Order of the House of the 22nd February, 1915, for a copy of all petitions, correspondence, complaints, reports and other documents relating to the dismissal of Alfred H. Bonnyman, postmaster of Mattatall Lake, in the county of Colchester, N.S. Presented 24th March, 1915.—*Mr. Sinclair*.. .. ..*Not printed.*

205. Return to an Address to His Royal Highness the Governor General, of the 1st March, 1915, for a copy of all correspondence, documents, charges, evidence, findings and Orders in Council in reference to the dismissal of John Thomas, postmaster at Hammond's Plain, Halifax County, N.S. Presented 24th March, 1915.—*Mr. Maclean (Halifax)*.. .. ..*Not printed.*

205*a*. Supplementary Return to an Address to His Royal Highness the Governor General, of the 1st March, 1915, for a copy of all correspondence, documents, charges, evidence, findings and Orders in Council in reference to the dismissal of John Thomas, postmaster at Hammond's Plain, Halifax County, N.S. Presented 8th April, 1915.—*Mr. Maclean (Halifax)*... .. ..*Not printed.*

206. Certified copy of a Report of the Committee ofthe Privy Council, approved by His Royal Highness the Governor General, with reference to the question of providing adequate pensionary assistance for officers and men disabled or partially disabled on active service or for the dependents of such officers and men should they be killed on active service. Presented by Sir Robert Borden, 24th March, 1915... .. .. *Not printed.*

207. Return to an Order of the House of the 8th March, 1915, for a return showing:—1. From how many firms or private individuals the Government, or any department of the Government has ordered saddles since the 1st of July, 1914? 2. The names of these firms? 3. How many saddles have been ordered from each firm? 4. How many saddles each firm has delivered up to date? 5. How many saddles each firm has yet to deliver? 6. The price each firm is receiving for these saddles? Presented 26th March, 1915.—*Mr. Murphy*.. .. ..*Not printed.*

208. Return to an Order of the House of the 8th March, 1915, for a copy of all correspondence, letters, telegrams and other documents relating to the dismissal of Mr. P. B. Hurlbert, postmaster at Springdale, Yarmouth County, N.S., and the removal of the office. Presented 30th March, 1915.—*Mr. Law*.. .. ..*Not printed.*

209 Return to an Order of the House of the 8th March, 1915, for a copy of all letters, petitions, telegrams and correspondence between the Hon. L. P. Pelletier, ex-Postmaster General and any person or persons of the county of Lévis, which during the month of April, 1912, had any connection with the appointment of G. A. Marois to a position in the customs office at Quebec, and the appointment of J. E. Gingras as postmaster of St. Romuald and Etchemin. Presented 30th March, 1915.—*Mr. Bourassa.*
Not printed.

210. Return to an Order of the House of the 22nd February, 1915, for a copy of all letters, telegrams, petitions and documents of all kinds in possession of the Post Office Department, referring in any way to the conduct of the postmaster at Grand Etang since his appointment until the present date. Presented 30th March, 1915.—*Mr. Chisholm (Inverness)*.. .. ..*Not printed.*

211. Return to an Order of the House of the 1st March, 1915, for a copy of all telegrams, letters, papers, documents, evidence and reports, in connection with the dismissal of Charles H. Marshall as postmaster at Nanton, Alberta. Presented 30th March, 1915.—*Mr. Warwick*.. .. ..*Not printed.*

212. Return to an Order of the House of the 1st March, 1915, for a copy of the report of the officer in charge of the lobster hatchery at Port Daniel West, and of the report of the inspection thereof for the season 1914. Presented 31st March, 1915.—*Mr. Marcil.*
Not printed.

213. Return to an Order of the House of the 24th February, 1915, for a copy of all correspondence, petitions, documents, etc., in connection with a petition of Donald Williams and others in respect to the regulation of fish traps in Green Harbour and vicinity. Presented 31st March, 1915.—*Mr. Law*.. .. ..*Not printed.*

214. Return to an Order of the House of the 9th February, 1915, for a copy of all correspondence, petitions, departmental recommendations and other papers and documents in the Department of Marine and Fisheries relating to the definition of a "coasting voyage," as defined in the Canada Shipping Act since the revision of the statutes in 1886. Presented 1st April, 1915.—*Mr. Sinclair*.. .. ..*Not printed.*

215. Return to an Order of the House of the 1st March, 1915, for a copy of all advertisements, tenders, contracts, vouchers, letters, documents, etc., relating to the establishment of the ferry service between the City of Halifax and Dartmouth, N.S., for the employees of the Marine and Fisheries Department at Halifax, N.S. Presented 1st April, 1915.—*Mr. Maclean (Halifax)*.. .. ..*Not printed.*

CONTENTS OF VOLUME 28—*Continued.*

216. Return to an Order of the House of the 24th February, 1915, for a copy of all pay-rolls, vouchers in detail, correspondence and all other documents in connection with the following public wharves in Shelburne: breakwater or wharf at East Green Harbour; shed on public wharf at Shelburne, and repairs to Gunning Cove wharf. Presented 1st April, 1915.—*Mr. Law*.. .. .. .

CONTENTS OF VOLUME 28—*Continued.*

228. Return to an Address to His Royal Highness the Governor General of the 19th February, 1915, for a copy of all Orders in Council, letters and telegrams exchanged between the Dominion Government and the several provinces, concerning the proposed transfer of fisheries in tidal waters from the Provincial to the Federal control. Presented 1st April, 1915.—*Mr. Lemieux*.. .. .. .

CONTENTS OF VOLUME 28—*Continued.*

239. Return to an Address to His Royal Highness the Governor General, of the 23rd February, 1915, for a copy of all letters, telegrams, reports, recommendations, Orders in Council and all other documents and papers in connection with rewards to the officers and crews of steamers *John L. Cann* and *Westport III*, for their heroic efforts in saving the passengers and crews of ss. *Cobequid*, wrecked on Trinity Ledge, 13th January, 1914. Presented 7th April, 1915.—*Mr. Law*.. .. ..*Not printed.*

240. Return to an Order of the House of the 29th March, 1915, for a copy of all documents, letters, telegrams, reports, etc., relating to the dismissal of Alexandre Blais, of the city of Lévis, from the position of customs officer at Bradore Bay, and the appointment of his successor or successors. Presented 7th April, 1915.—*Mr. Bourassa*.. ..*Not printed.*

241. A Return to an Address of the Senate dated 18th March, 1915, for:—1. A return showing all appointments to the Civil Service, Department of the Interior, in that area contained in the present constituencies of Medicine Hat and Macleod, giving names, date of appointment, how appointed, and salaries from the year 1896 to the present date. 2. Also, all vacancies by death, resignation or dismissal, giving name, date, length of service and cause of dismissal in the same area and during the same period.—(*Senate*). *Not printed.*

242. Return to an Order of the House of the 1st March, 1915, for a copy of charges made against J. Herbert Sweetman, customs officer at Port Daniel Centre, Quebec, which brought about his dismissal; and also of charges against Velson Horie, lighthouse keeper at Port Daniel West, Quebec, which brought about his dismissal. Presented 8th April, 1915.—*Mr. Marcil* (*Bonaventure*).. .. .. *Not printed.*

243. Return to an Order of the House of the 22nd February, 1915, for a copy of all correspondence, recommendations, petitions, contracts, tenders and other papers and documents in any way connected with the letting of the contract for carrying the mails between Guysborough and Erinville, N.S. Presented 8th April, 1915.—*Mr. Sinclair.* *Not printed.*

244. Return to an Order of the House of the 10th March, 1915, for a copy of all reports, petitions, letters, telegrams and other documents in connection with the dismissal of W. M. Thomson from the postmastership at Fort Qu'Appelle, and of any petition or petitions for his reinstatement, and of all correspondence in connection therewith. Presented 8th April, 1915.—*Mr. Thomson* (*Qu'Appelle*).. .. ..*Not printed*

245. Return to an Order of the House of the 22nd March, 1915, for a copy of all letters, telegrams, correspondence and petitions received in the Post Office Department, in any way referring to the calling of tenders for the Antigonish-Sherbrooke mail service, which tenders were opened or due at the Post Office Department on the 11th December last; and of all representations or requests, recommending or suggesting that new tenders should be invited as was done early in February last. Presented 8th April, 1915. —*Mr. Chisholm* (*Inverness*).. .. ..*Not printed.*

246. Return to an Order of the House of the 3rd March, 1915, for a copy of all letters, telegrams, papers and other documents in regard to a proposed rural mail delivery service between Pictou and Saltsprings, Pictou county, and as to the arrangements for the existing service between those points. Presented 8th April, 1915.—*Mr. Macdonald.* *Not printed.*

247. Return to an Address of His Royal Highness the Governor General, of the 1st March, 1915, for a copy of all letters, telegrams, reports, recommendations, Orders in Council, and all other documents and papers whatsoever relating to or in any wise connected with the establishment of rural mail routes and deliveries from Bridgetown to Granville Ferry, county of Annapolis, and especially of all letters, telegrams, reports, recommendations and documents relating to the closing of the post offices at Belleisle, Upper Granville, and the establishment of the post office at Granville Centre, all in the county of Annapolis. Presented 8th April, 1915.—*Mr. Macdonald*.. .. ..*Not printed.*

248. Return to an Order of the House of the 22nd February, 1915, for a copy of all telegrams, letters, reports, petitions and all other documents in any way referring to the proposed line of railway from Orangedale to Cheticamp. Presented 9th April, 1915.—*Mr. Chisholm* (*Inverness*).. .. ..*Not printed.*

249. Return to an Order of the House of the 11th March, 1915, for a copy of all documents, investigations, reports, correspondence, etc., relating to the burning of certain buildings belonging to the Trois Pistoles Pulp and Lumber Company and to André Leblond, near Tobin station, on the Intercolonial Railway. Presented 9th April, 1915.—*Mr. Lapointe* (*Kamouraska*).. .. ..*Not printed.*

250. Return to an Order of the House of the 18th March, 1915, for a return showing the names of all officials, assistants and clerks, employed in the railway offices at Moncton, N.B., and the salary paid to each; also the names of officials formerly employed in said offices who have been retired on superannuation allowance, and the amount of retiring allowance being paid to each. Presented 9th April, 1915.—*Mr. Copp*.. ..*Not printed.*

CONTENTS OF VOLUME 28—*Continued.*

251. Return to an Order of the House of the 24th March, 1915, for a return showing the names of all persons from whom lands have been purchased, the quantity of land so acquired, and the amount paid therefor, in connection with the Dartmouth and Dean's Post Office Branch of the Intercolonial Railway since the date of return numbered 128 made to Parliament at the last regular session thereof. Presented 9th April, 1915.—*Mr. Maclean (Halifax)*.. .. .. .

CONTENTS OF VOLUME 28—*Continued.*

260*b*. Return to an Order of the House of the 8th March, 1915, for a return showing:—1. From how many firms or private individuals the Government or any department of the Government, has ordered service shirts since the 1st of July, 1914? 2. The names of these firms? 3. How many service shirts have been ordered from each firm? 4. How many each firm has delivered up to date? 5. How many each firm has yet to deliver? 6. The price each firm is receiving for these service shirts? Presented 10th April, 1915.—*Mr. Carroll*.. .. .. .

CONTENTS OF VOLUME 28—*Continued.*

267. Return to an Order of the House of the 17th March, 1915, for a copy of all petitions, letters, documents, etc., between persons in the province of Nova Scotia and the Department of Trade and Commerce since 1st August last, with regard to Atlantic ocean freight rates on subsidized steamers or otherwise. Presented 10th April, 1915.—*Mr. Maclean (Halifax)*.. .. .. .

CONTENTS OF VOLUME 28—*Continued.*

278. Return to an Order of the House of the 8th April, 1915, for a return showing:—1. The number of employees connected with the administration of the Three Rivers post office on the 21st September, 1911, and the annual amount paid in salaries at that date for such service. 2. The number of employees connected with the administration of the Three Rivers post office at the present date, and the amount of the annual salaries paid for such service. 3. The number of employees in the Customs Department for Three Rivers on the 21st September, 1911, and the amount of the annual salaries paid for such service. 4. The number of employees in the Customs Department for Three Rivers at the present date, and the annual amount of the salaries paid for such service. 5. The number of employees in the Inland Revenue Department for the district of Three Rivers on the 21st September, 1911, and the annual amount of salaries paid for such service. 6. The number of employees at the present date in the Inland Revenue Department for the district of Three Rivers, and the amount of the annual salaries paid for such service. 7. The number of employees, and the amount paid in salaries for the works on the St. Maurice, in the county of Champlain, during the year 1911-12. 8. The number of employees, and the amount of salaries paid per year for the works on the St. Maurice, in the county of Champlain, since 1911-12. 9. If the employees whose names follow, were dismissed on the 26th and 27th November, 1914, and the 4th and 5th January, 1915; Wildé Lavalée, Pierre Thicierge, Joseph Paquin, sr., Joseph Paquin, jr., Athanase Gélinas, clerks. 10. If so, at whose request, and for what reasons. 11. If those days were taken off the salaries of such employees. Presented 13th April, 1915.—*Mr. Bureau*.. .. .. .

CONTENTS OF VOLUME 28—*Continued.*

289. Report and evidence upon the matter known as: "Grazing Ranch No. 2422, J. G. Turriff, A. J. Adamson, and J. D. McGregor." Presented by Hon. Mr. Coderre, 13th April, 1915.. .. .. .

SUPPLEMENT TO THE ANNUAL REPORT OF THE DEPARTMENT OF THE INTERIOR

THIRTEENTH REPORT

OF THE

GEOGRAPHIC BOARD OF CANADA

CONTAINING ALL DECISIONS TO MARCH 31

1914

PRINTED BY ORDER OF PARLIAMENT

OTTAWA
PRINTED BY J. DE L. TACHÉ, PRINTER TO THE KING'S MOST EXCELLENT MAJESTY.
1914

[No. 25*d*—1915.]

To the Hon. W. J. Roche, M.P.,
Minister of the Interior,
Ottawa.

Sir,—I have the honour to submit the Thirteenth Report of the Geographic Board of Canada, to be printed as a supplement to the Annual Report of the Department of the Interior. The index has been rearranged and the descriptive matter corrected to agree with the new provincial, county and district boundaries. A large addition of decisions is included in the consolidation which has been completed to the end of the fiscal year, March 31, 1914.

I have the honour to be, sir,
Your obedient servant,

E. DEVILLE,
Chairman of the Board.

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Appendix—

An outline of the Physical Geography of Canada. 17 pp.

ORDER IN COUNCIL

THE CANADA GAZETTE.

OTTAWA, Saturday, June 25, 1898.

[*8324*]

AT THE GOVERNMENT HOUSE AT OTTAWA.

SATURDAY, DECEMBER 18, 1897.

PRESENT:

HIS EXCELLENCY THE GOVERNOR GENERAL IN COUNCIL.

His Excellency, by and with the advice of the Queen's Privy Council of Canada is pleased to create a 'Geographic Board' to consist of one member for each of the Departments of the Geological Survey, Railways and Canals, Post Office, and Marine and Fisheries, such member, being appointed by the Minister of the department; of the Surveyor General of Dominion Lands, of such other members as may from time to time be appointed by Order in Council, and of an officer of the Department of the Interior, designated by the Minister of the Interior, who shall act as secretary of the Board; and to authorize the Board to elect its chairman and to make such rules and regulations for the transaction of its business as may be requisite.

His Excellency is further pleased to order and direct, that all questions concerning geographic names in the Dominion which arise in the departments of the public service shall be referred to the Board, and that all departments shall accept and use in their publications the names and orthography adopted by the Board.

JOHN J. McGEE,
Clerk of the Privy Council.

Extract from Order in Council dated December 14, 1899.

"That the Order in Council constituting the Board be amended by giving to the government of the Northwest Territories and to each Province the right to nominate one of their officials as a member of the Board who shall advise the Board with reference to names in his Province, provided that the several governments undertake to be guided by the decisions of the Board."

MEMBERS OF THE GEOGRAPHIC BOARD OF CANADA

Chairman

E. Deville, Surveyor-General of Dominion Lands.

Secretary

A. H. Whitcher, Department of the Interior.

Executive Committee.

D. B. Dowling, Geologist, Geological Survey, Department of Mines.

C. O. Senécal, Geographer and Ch. Draughtsman, Geol. Survey, Dept. of Mines.

James White, Assistant Chairman, Commission of Conservation.

Members.

Wm. P. Anderson, Chief Engineer, Department of Marine and Fisheries.

W. H. Boyd, Topographer, Geological Survey, Department of Mines.

A. G. Doughty, Dominion Archivist.

E. V. Johnson, Inspecting Engineer, Department of Railways and Canals.

Vacant, Post Office Department.

Provincial Representative Members.

(Order in Council, December 14, 1899.)

Ontario—
Aubrey White, Deputy Minister of Lands and Forests, Toronto, Ont.

Quebec—
Eugene Rouillard, President, Quebec Geographic Board, Quebec.

New Brunswick—
Wm. S. Carter, Chief Superintendent of Education, Fredericton, N.B.

Nova Scotia—
A. H. MacKay, Superintendent of Education, Halifax, N.S.

Prince Edward Island—
Hon. M. McKinnon, Provincial Secretary, (ex-officio), Charlottetown, P.E.I.

British Columbia—
Wm. Fleet Robertson, Provincial Mineralogist, Victoria, B.C.

Alberta—
L. C. Charlesworth, Director of Surveys, Edmonton, Alta.

Saskatchewan—
A. J. McPherson, Chairman, Local Government Board, Regina, Sask.

GEOGRAPHIC BOARD OF CANADA

BY-LAWS.

I—Officers of the Board.

The officers shall consist of a chairman (who shall be elected by ballot), of an executive committee of three to be nominated by the chair and approved by the Board, all of whom shall serve for one year or until their successors shall be chosen, and of the secretary.

II—Duties of Officers.

(*a.*) The chairman shall preside at the meetings and shall certify to the decisions of the Board. He shall appoint all committees not specially named by the Board. In his absence the Board shall have power to elect a temporary chairman.

(*b.*) The secretary shall keep minutes of the proceedings of the Board and shall record the decisions rendered, or other action of the Board upon cases submitted to it, with reference to the papers filed in each case. He shall maintain files of the original papers, or copies of them, that may be presented in each case, conveniently arranged for reference. He shall, under the instructions of the Board, conduct the general correspondence and shall receive communications presented for the consideration of the Board.

(*c.*) The executive committee shall receive through the secretary all communications requiring decision by the Board, shall investigate the questions presented, and after securing information from all available sources, shall report to the Board with recommendations regarding them.

(*d.*) Before dealing with any name within a province represented upon the Board, such name shall be submitted to the representative of said province for examination and report.

(*e.*) Upon the receipt of a communication submitting place-names for the consideration of the Board, it shall be the duty of the secretary, after preliminary submission to the executive committee, to transmit at once a copy of such communication, together with any papers relating thereto, to the member of the Board for the province affected, and also, in the case of coast names appearing on admiralty charts, to the hydrographer of the admiralty.

(*f.*) So soon as the report of the provincial representative, and in the case of chart names, the report of the hydrographer, are received, the secretary shall immediately submit the whole correspondence to the executive committee who shall promptly prepare the names for submission to the Board.

(*g.*) The secretary shall enter upon every record submitted for the consideration of the Board, the recommendation of the provincial representative, and, if any, the recommendation of the hydrographer.

III—Meetings.

The Board shall hold regular meetings on the first Tuesday in each month. Special meetings may be called by the chairman or by the executive committee. Five members of the Board shall constitute a quorum, but on the written request of any member, filed with the secretary of the Board within a month from the date of a meeting, any decision adopted at such meeting shall be reserved for approval by a

majority of the full Board. The affirmative vote of a majority of all the members of the full Board shall be required for the final decision in any case. All motions presented for the consideration of the Board shall be submitted in writing.

IV—Reports.

The Board shall publish its decisions on geographic names, after each meeting, in the *Canada Gazette* and in bulletins, the same to be consolidated in a general report of the Board's work, to be issued after the 31st of March in each year.

V—Amendment.

These by-laws may be amended at any regular or special meeting, by a majority vote of all the members of the Board, provided that copies of the proposed amendment have been sent by the secretary to the members of the board at least twenty days previous to the time the vote is taken.

SESSIONAL PAPER No. 25d

RULES OF NOMENCLATURE.

1. When the priority of a name has been established by publication, particularly when such publication has occurred in any standard or authoritative work or works, that name should, if possible, be retained.

2. When names have been changed or corrected, if not too firmly established by local usage or otherwise, the original forms should be restored.

3. In cases where what was evidently originally the same word, appears with various spellings sanctioned by local usage or otherwise, these various spellings when applied to different features should be regarded as in effect different names, and as a rule it is inadvisable to attempt to produce uniformity.

4. As a rule the first published name should be retained, but where a choice is offered between two or more names for the same place or locality, all sanctioned by local usage, that which is most appropriate and euphonious should be adopted.

5. The possessive form should be avoided whenever it can be done without destroying the euphony of the name or changing its descriptive application. Where the possessive form is retained, the apostrophe should be dropped.

6. It is desirable to avoid the use of hyphens to connect parts of Indian names

7. Names consisting of more than one word may be connected by hyphens or combined in one word as may be advisable.

8. It is desirable to avoid the use of the words city and town as parts of names.

9. The form "canyon" may be used instead of "cañon," but the latter is preferable.

10. The term "brook" is considered preferable to "creek" for designating small streams, and will be adopted in cases where the latter has not become too firmly fixed.

11. The Board suggests that the initial letters of generic or descriptive parts of geographical names, when used in reports or other documents, should not be capitals.

12. The use of alternative names should be discontinued where possible or not inconvenient.

13. Geographical names in a foreign country should be rendered in the form adopted by that country, except where there are English equivalents already fixed by usage.

14. French names in Canada are to be spelt, accented, hyphenated, &c., according to the rules of the French language.

15. In cases where names already exist, and have been published in both English and French form and have been sanctioned by long usage, no attempt shall be made to abolish either form, but both may be recognized and published in the Board's lists of decisions and it shall be deemed correct to use either form in official documents in either language. In all other cases any duplication of form shall be discouraged and preference shall be given to the form which has priority of origin, whether this be English or French.

16. In English text and map printing, the use of hyphens for composite French names, though it is recommended, shall not be considered obligatory.

17. The spelling of native geographical names should represent, approximately, the true sounds of the words as pronounced in the native tongue. In the orthography of names of Indian origin in the province of Quebec, the rules of the Board, based on those of the Royal Geographical Society, are preferable to French practice as being simpler and in accordance with international usage, and shall be followed in the case of new names.

18. Where a generic descriptive term, such as Cape, Bay, River, etc. is added to a name, it is permissible to translate such term into French for use in French

publications, or into English for use in English publications, if it can be done without producing a mixture of English and French.

19. The Board adopts the rules of the Royal Geographical Society for the orthography of geographical names, of which the broad features are as follows:—

(*a*) The vowels are to be pronounced as in Italian and the consonants as in English.

(*b*) Every letter is pronounced, and no redundant letters are introduced. When two vowels come together each one is sounded, though the result, when spoken quickly, is sometimes scarcely to be distinguished from a single sound, as in *ai, au, ei.*

(*c*) One accent only is used, the acute, to denote the syllable on which stress is laid. This is very important, as the sounds of many names are entirely altered by the misplacement of this "stress."

The following amplification of the foregoing rules explains their application:—

Letters.	Pronunciation and Remarks.	Examples.
a	*ah*, *a* as in *father*.	Java, Banana, Somali, Bari.
e	*eh*, *a* as in *fate*.	Tel el Kebir, Oleleh, Yezo, Medina, Levuka, Peru.
i	English *e*: *i* as in *ravine*: the sound of *ee* in *beet*.	
	Thus, not *Feejee*, but	Fiji, Hindi.
o	*o* as in *note*.	Tokyo.
u	long *u* as in *flute*; the sound of *oo* in *boot*. *oo* or *ou* should never be employed for this sound. Thus, not *Zooloo*, but	Zulu, Sumatra.
	All vowels are shortened in sound by doubling the following consonant.	Yarra, Tanna, Mecca, Jidda
	Doubling a vowel is only necessary when there is a distinct repetition of the single sound.	Nuuhua, Oosima.
ai	as in *aisle*, or English *i* as in *ice*.	Shanghai.
au	*ow* as in *how*. Thus, not *Foochow*, but	Fuchau.
ao	is slightly different from above	Macao.
aw	when followed by a consonant or at the end of a word, as in *law*.	Cawnpore.
ei	is the sound of the two Italian vowels, but is frequently slurred over, when it is scarcely to be distinguished from *ei* in the English *eight* or *ey* in the English *they*.	Beirut, Beilul.
b	English *b*.	
c	is always soft, but is so nearly the sound of *s* that it should be seldom used.	Celebes.
	If *Celebes* were not already recognized it would be written *Sclebes*.	
ch	is always soft as in *church*.	Chingchin.
d	English *d*.	
f	English *f*. *ph* should not be used for the sound of *f*.	
	Thus, not *Haiphong*, but	Haifong, Nafa.
g	is always hard. (Soft *g* is given by *j*).	Galapagos.
h	is always pronounced when inserted.	
hw	as in *what*: better rendered by *hw* than by *wh*, or *h* followed by a vowel, thus *Hwang ho*, not *Whang ho*, or *Hoang ho*.	Hwang ho, Ngan hwei.
j	English *j*. *Dj* should never be put for this sound.	Japan, Jinchuen.
k	English *k*. It should always be put for the hard *c*.	
	Thus, not *Corea*, but	Korea.
kh	The Oriental guttural	Khan.
gh	is another guttural, as in the Turkish.	Dagh, Ghazi.
l m n	As in English.	
ng	has two separate sounds, the one hard as in the English word *finger*, the other as in *singer*. As these two sounds are rarely employed in the same locality, no attempt is made to distinguish between them.	
p	As in English.	
ph	As in *loophole*.	Chemulpho, Mokpho.
th	stands both for its sound in *thing*, and as in *this*. The former is most common.	Bethlehem.
q	should never be employed; *qu* (in *quiver*) is given as *kw*.	Kwangtung.
	When *qu* has the sound of *k* as in *quoit*, it should be given by *k*.	
r s sh t v	As in English.	
w		Sawakin.
x		
y	is always a consonant, as in *yard*, and therefore should never be used as a terminal, *i* or *e* being substituted as the sound may require.	Kikuyu.
	Thus, not *Mikindany*, but	Mikindani.
	not *Kwaly*, but	Kwale.
z	English *z*.	Zulu.
zh	The French *j*, or as *s* in *treasure*.	Muzhdaha.
	Accents should not generally be used, but where there is a very decided emphatic syllable or stress, which affects the sound of the word, it should be marked by an *acute* accent.	Tongatábu, Paiáwon, Sarawak.

DECISIONS

In the following list of names, those approved by the Board are printed in black type. Names, and different forms of the same name, which have been discarded are also given; the former being printed in *italics* and alphabetically arranged with the adopted names, but the latter, when nearly like the adopted forms, are not repeated.

A

Abatagush; bay, at the south end of Mistassini lake, Mistassini territory, Que.

Abbika. See Apika.

Abbot; pass, near mount Lefroy, Alta. and B.C.

Abbott; mount, south of Glacier station, Kootenay district, B.C.

Abbott Corners; village, Missisquoi county, Que. (Not Abbotts Corners.)

Abenakis; river, tributary to Etchemin R., Bellechasse Co., Que. (Not Abenaquis.)

Aberdeen; mount, northeast of mount Lefroy, Alta. (Not Hazel peak.)

Abitibi; territory, Que., also lake on boundary line between Ontario and Quebec, and river flowing from the lake to Moose river, Ont. (Not Abitibbi, Abittibi, nor Abittibbi.)

Abloviak; bay, east shore of Ungava bay, New Quebec. (Not Ablorialik.)

Aboushagan; river, Westmorland county, N.B. (Not Abouchagan, Aboushogan, Aboushagin, nor Abougoggin.)

Abraham. See Abram.

Abram; lake, north of Minnitaki lake, Kenora district, Ont. (Not Abraham nor Abram's.)

Acheninni; lake, on Grassberry river, central Saskatchewan. (Not Blackfeet.)

Achigan; lake and river, tributary to L'Assomption river, Terrebonne county, Que. (Not L'Achigan.)

Achigo. See Sachigo.

Active; pass, between Galiano and Mayne islands, in the southern portion of the strait of Georgia, B.C. (Not Plumper's.)

Acton Corners; post office, Grenville county, Ont. (Not Acton's Corners.)

Actonvale; town, Bagot county, Que. (Not Acton Vale.)

Adam; lake, west of Fluke lake, Kenora district, Ont.

Adamant; glacier, mountain, and range, Selkirk mountains, Kootenay district, B.C.

Adams; creek, branch of Bonanza creek, Klondike river, Yukon.

Adams; lake and river, emptying into the westerly end of Shuswap lake, Kamloops district, B.C.

Adelaide; island, northeast of Grenadier island, St. Lawrence R. Leeds county, Ont.

Admiral. See Saltspring.

Admiralty; group of islands, St. Lawrence R., south of Gananoque, Leeds Co., Ont.

Adstock; township and village, Frontenac county, Que.

Advance; reef, off Michael point, Manitoulin island, Manitoulin district, Ont.

Affleck; lake, northwest of Rosamond lake, Kenora district, Ont.

Afton; mount, south of mount Abbott, Selkirk mountains, Kootenay district, B.C.

Agawa; bay, islands, point, and river, Manitoulin district, Ont. (Not Aguawa.)

Agnes; lake, west of lake Louise, Alta. (Not The Goat's Looking Glass.)

Agotawekami. See Duparquet.

Aguawa. See Agawa.

A. H. Ward. See Ward.

Ahwillgate. See Awillgate.

Aiabewatik; lake, east of Anzhekumming lake, Kenora district, Ont.

Aigles; (lac et rivières des) lake and river, tributary to Mattawin river, St. Maurice county, Que. (Not Eagle.)

Aiktow; creek, flowing into the S. Saskatchewan at 'The Elbow,' Sask.

Ainslie; shoal, south of Girouard point, Manitoulin island, Manitoulin district, Ont.

Airy; mount, east of mount Stanley, Kootenay district, B.C.

Aishihik; lake, and river tributary to the Dezadeash, southwestern Yukon.

Aiskew; island, northward of Frank point, western shore of Observatory inlet, Cassiar district, B.C.

Akamina; creek, tributary to Kishinena creek, near international boundary, Kootenay district, B.C., also pass, Alta. and B.C. (Not Akimina.)

Akamina. See Starvation.

Akolkolex; river, tributary to Columbia river, between Arrowhead and Revelstoke, Kootenay district, B.C. (Not Akotkolex.)

Akos; lake, at head of Kamachigama R., Montcalm Co., Q. (Not Akonse nor Akoney.)

Akotkolex. See Akolkolex.

Akpatok; island, Ungava bay, New Quebec.

Akpatok. See Aukpatuk.

Akuinu; river, tributary to Athabaska river, Alta. (Not A-kew-i-new.)

Akuling; inlet, north shore of Hudson strait, N.W.T. (Not A-ku-ling.)

Akwatuk; bay and river, south of Big river, New Quebec. (Not Aquatuk.)

Albanel; lake, east of Mistassini lake, Mistassini territory, Que. (Not Little Mistassini nor Mistassinis.) Mistassini lake and the lake called in recent years 'Little Mistassini' or 'Mistassinis,' were explored in 1762 by Père Charles Albanel, a Jesuit missionary, when on his way from L. St. John to Hudson bay *via* Rupert river. Père Albanel gave his name to the smaller lake and it is so named on the maps of Laure 1732, Bellin 1755, D'Anville 1755 and others from 1763 to 1794. In view of this evidence and the recommendation of the advisory member of the Board representing the province of Quebec, the previous decision has been revised.

Albee; lake, Montbeillard township, Pontiac county, Quebec.

Albert; canyon, creek, glacier, peak, and snowfield, east of Illecillewaet river, Kootenay district, B.C.

Albert; port, Huron county, Ont.

Albert; town, in Albert county, N.B. (Not Hopewell Corner.)

Albert. See Anderson.

Alberta; province, also Mt. Alberta north of Mt. Columbia, Rocky Mts., Alta.

Albert Edward; mount, east of Buttle lake, Vancouver island, B.C.

Albury; post village, Ameliasburg township, Prince Edward county, Ont.

Alcott; creek, flowing northeasterly into Chitek river, central Sask. (Not Rat.)

Aldborough; post office and township, Elgin county, Ont. (Not Aldboro.)

Aldridge; lake, west of Obowanga river, Thunder Bay district, Ont.

Alemek. See Lamek.

Alex; river, flowing into L. St. John, Lake St. John county, Que.

Alexander; creek, tributary to Michel creek, Kootenay district, B.C. (Not North Fork of Michel creek.)

Alexander; railway station, slough, and village, Manitoba. (Not The Big slough.)

Alexandra; lake, Smellie township, Kenora district, Ont.

Alexandra; mount, west of Mt. Lyell, summit range of the Rockies, Alta., and Kootenay district, B.C.

Alexis; creek and lake, tributary to Chilcotin river, also Alexis Creek, post office, Cariboo district, B.C.

Alford; post office and railway station, Brant county, Ont. (Not Alford Junction.)

Alford Junction. See Alford.

Algernon; rock, in St. Lawrence river, southeast from 'Stone Pillar,' below Goose island, L'Islet county, Que. (Not Roche à Veillons nor South.)

Alice; lake, northeast of Bow lake, Alberta.

Alki; creek, tributary to Klondike river, Yukon.

Allan; lake, east of Wallace river, and river tributary to Saulteux river, central Alberta.

Allan; point, south of Dorval, Jacques Cartier county, Que. (Not Marion.)

Allan Corners; post office, Chateauguay county, Que. (Not Allan's Corners.)

Allan Mills; settlement, Lanark county, Ont. (Not Allan's Mills.)

Allanwater; river, emptying into Wabakami lake, Thunder Bay district, Ont.

Allard; river, emptying into Mattagami lake, Abitibi, Que. (Not Mattagami.)

Allen; island, west of Beekman peninsula, N.W.T.

Allgold; creek, tributary to Klondike river, Yukon.

Alligator; lake and mountain, north of Watson river, southern Yukon.

Allumette; lake, an expansion of Ottawa river, Renfrew county, Ont. (Not Pembroke.)

Allumette. See Chalk.

Alma; creek, tributary to Klondike river, Yukon.

Alouettes, (pointe aux); point, at southern entrance to Saguenay river, Saguenay county, Que. (Not Lark point nor Pte. Aux Alouette.)

Alsek; river, formed by the junction of the Dezadeash and Kaskawulsh, Cassiar district, B.C., and Yukon. (Not Alseek nor Altsek.)

Altrude; creek, flowing from a group of small lakes of same name, near Vermilion pass, to Bow river, west of Castle station, Alta. (Not Little Vermilion.)

Alukpaluk; bay, southeast shore of Ungava bay, New Quebec.

Alwin; rock, west of Bigsby island, at entrance to Key harbour, Georgian bay, Parry Sound district, Ont.

Amazon. See Milton.

Ambella. See Arabella.

Ameliasburg; township, Prince Edward county, Ont. (Not Ameliasburgh.)

Amherst; island, in lake Ontario, Addington county, Ont.

Amik; lake, south of Minnitaki lake, Kenora district, Ont.

Amikitik. See LaSarre.

Amiskwi; peak, at headwaters of Amiskwi R. Rocky Mts., Kootenay district, B.C.

Amiskwi; river, tributary to Kicking Horse river, Kootenay district, B.C. (Not Beavertail nor North Branch of Kicking Horse river.)

Ammerman; mountain, a spur of Davidson mountains, international boundary, Alaska and Yukon.

Amos; village, Figuery township, Timiskaming county, Que.

Amy; point, at north end of Gribbell island, Coast district, B.C.

Anaham. See Anahim.

Anahim; creek, tributary to Chilcotin river, also lake and Indian Reserve, Cariboo district, B.C. (Not Anaham.)

Anamebini; river, tributary to Severn R., Patricia district, Ont. (Not Anamabine.)

Anderson; channel, east of Beekman peninsula, N.W.T.

Anderson; lake, southwest of Seton lake, Lillooet district, B.C.

Anderson; mount, south of Wheaton river, southern Yukon.

Anderson; point N.E. entrance to Washow bay, L. Winnipeg, Man. (Not Albert.)

Anderson. See Henderson.

Anderson Corners; settlement, Huntingdon county, Que. (Not Anderson's Corners.)

Anerley; lake, Tp. 28, Rges. 9 and 10, W. 3 M. Sask. (Not Red Deer.)

Anesty. See Anstey.

Ange Gardien de Rouville. See Canrobert.

Angle; mountain, in the angle formed by the Seymour arm of Shuswap lake, Kamloops district, B.C.

Angle peak. See The Vice-President.

Ann; point, Upper Arrow lake, Kootenay district, B.C. (Not Lone Tree.)

Anne; point, opposite Massasauga point, Hastings county, Ont.

Annette; lake, north of mount Temple, Alta.

Annie; lake, north of the 'big bend' of Wheaton river, southern Yukon.

Annimwash; bay, in L. St. Joseph, and lake north of L. St. Joseph, Patricia, Ont.

Anse-à-Beaufils; post settlement, Gaspe county, Que. (Not L'Anse au Beaufils.)

Anse-au-Vallon; village, Gaspe county, Que. (Not L'Anse-à-Valleau.)

Anstey; arm (Shuswap lake), creek, lake, and river, Kamloops district, B.C. (Not Anesty.)

Anstey; mount, Selkirk range, Kootenay district, B.C.

Anstruther; lake and township, Peterborough county, Ont. (Not Eagle.)

Ant. See Deacon.

Anticline; mountain, between headwaters of Nordenskiöld R. and L. Laberge, Yukon.

Antler; creek, tributary to Souris river, southern Man. and Sask. (Not South Antler.)

Antonio; point, southerly extremity of Maurelle island, Coast district, B.C.

Anuk; river, tributary to Stikine river, Cassiar district, B.C.

Anvil; mountain, between Cottonwood and Dease rivers, Cassiar district, B.C.

Anwatan; lake, east of Grand lake Victoria, Pontiac county, Que.

Anzhekumming; lake, northeast of Manitou lake, Kenora district, Ont. (Not Upper Manitou.)

Apeganau; river, tributary to Burntwood river, Manitoba. (Not Muddy Water.)

Apika; brook, flowing into head of lake Timiskaming, Que. (Not Abbika.)

Apussigamasi; lake, on Burntwood river, Manitoba. (Not Appussigamahsin.)

Aquatuk. See Akwatuk.

Arabella; island, south of Francis island, between Grindstone and Wolfe islands, St. Lawrence river, Frontenac county, Ont. (Not Ambella.)

Arbutus; rock, south of cape Hurd, Bruce county, Ont.

Arbutus. See Saddle.

Arcand; bay, in Ottawa river, west of Montebello, Ottawa county, Que. (Not Arcans, Cardinal's, nor Charlebois.)

Arcans. See Arcand.

Archibald; bay, north shore of Hudson strait, N.W.T.

Arcola; lake, Tp. 10, R. 3, W. 2 M. Sask. (Not Fish.)

Arcs (lac des); lakes, south of Bow river, Rocky Mountains park, Alberta.

Ardoise. See L'Ardoise.

Argentine; mountain and glaciers, between north and south branches of Gold river, Selkirk mountains, Kootenay district, B.C.

Argonaut; mountain, between heads of Bigmouth and French creeks, Selkirk mountains, Kootenay district, B.C.

Argyle; creek, tributary to St. Mary river, Kootenay district, B.C.

Argyle; islands, northwest of Burke island, Bruce county, Ont.

Arignole. See Original.

Arkansas; creek, tributary to Dominion creek, Indian river, Yukon.

Ark-e-leenik. See Thelon.

Arkell. See Kusawa.

Arlington; lakes and mountain, west of the west fork of Kettle river, Similkameen district, B.C.

Arm; islands, Southgate group, Queen Charlotte sound, Coast district, B.C.

Arm; river, flowing into the southern portion of Last Mountain lake, southern Sask.

Armit; river, flowing into Red Deer lake, Man. and Sask. (Not Armitt.)

Armitt. See Armit.

Armstrong; lake, Redditt township, Kenora district, Ont.

Armstrong. See Downey.

Arnet; island, southwest of Stone island, Clayoquot sound, Vancouver island, B.C.

Aroma; lake, northeast of Tramping lake, Sask.

Aroostook; river, tributary to St. John river, Victoria county, N.B. (Not Arostook.)

Arosen; island, in Ottawa river, west of Montebello, Ottawa county, Que. (Not Arouson, Rousseau, nor Roussin.)

Arrow; lake and river, tributary to Pigeon river, Thunder Bay district, Ont.

Arrowpark; creek, tributary to Columbia river, Kootenay district, B.C. (Not Mosquito.) Previous decision revised.

Arrowsmith; mount, southeast of Alberni, Vancouver island, B.C.

Arrowwood. See Rosebud.

Arthuret; village, Victoria county, N.B. (Not Arthurette.)

Arthur Land. See Ellesmere.

Arthur Seat; mountain, near Nahlin river, Cassiar district, B.C. (Not Arthur's.)

Arva. See Medway.

Asapikona. See Faucher.

Ascot; post office, Sherbrooke county, Que. (Not Ascot Corner.)

Ash; brook, northeast of Nozheiatik lake, Kenora district, Ont.

Ash; lake, Redditt township, Kenora district, Ont.

Ash. See Lynedoch.

Asham; point, southwest of Peonan point, lake Manitoba, Man.

Ashby; lake and township, Addington county, Ont. (Not Island lake.)

Ashe; inlet, south shore of Big island, Hudson strait, N.W.T.

Ashe; lake, northeast of Blaine lake, central Saskatchewan.

Asheigamo; lake, S. of L. Hill, Kenora district, Ont. (Not Bass nor Tasheigama.)

Asheweig; river, tributary to Winisk river, Patricia, Ont. (Not West Winisk.)

Ashnola; river, tributary to Similkameen river, southern B.C. (Not Ashnoulou.)

Ashton; point, Douglas channel, opposite Maitland island, Coast district, B.C.

Ashuapmuchuan; lake and river, Lake St. John county, Que.

Asinitchibastat; lake, west of Chibougamau lake, Abitibi territory, Que. (Not Asinitebastat.)

Asipimocasi. See Magusi.

Asippitti; river, tributary to Burntwood river, Manitoba.

Askikwaj. See LaMotte.

Askitichi; lake, headwaters of Ashuapmuchuan river, Chicoutimi county, Que.

Askow. See Bow.

Askwahani. See Eskwahani.

Aspasia; island, southwest of Grenadier island, St. Lawrence R., Leeds county, Ont.

Aspatagoen. See Aspotogan.

Aspotogan; harbour, mountain, peninsula, and post office, Lunenburg county, N.S. (Not Aspatageon.)

Aspy; bay and river, Victoria county, N.S. (Not Aspec.)

Assiniboine; mount, Alta. and Kootenay district, B.C.

Assinika; lake, discharging into the upper Broadback river, Abitibi territory, Que.

Assinkepatakiso; lake, near Atikwa lake, Kenora district Ont.

Assiwanan; lake, at headwaters of St. Maurice river, Champlain county, Que. (Not Asiwawanan.)

Astounder; island, southwest of Axeman island, Lake Fleet group, St. Lawrence river, Leeds county, Ont.

Asulkan; brook, falls, glacier, pass, and ridge, Selkirk Mts., Kootenay district, B.C.

Atem. See Atim.

Athabaska; lake, in Alberta and Saskatchewan. (Not Athabasca.)

Athabaska; mount, at headwaters of Sunwapta river, also glacier, Rocky mountains, Alberta. (Not Athabasca.)

Athabaska; pass, at headwaters of Whirlpool river, Alberta, and Cariboo district, B.C. (Not Athabasca.)

Athabaska; river, Alberta. (Not Athabasca.)

Athabaska; town, on Athabaska river, central Alberta. (Not Athabaska Landing.) Previous decision revised.

Athalmer; town, on Columbia river below its outlet from Windermere lake, Kootenay district, B.C. (Not Athelmer.)

Athapapuskow; lake, west of Cranberry lake, Manitoba. (Not Athapuscow.)

Athol; bay, Athol township, Prince Edward county, Ont. (Not Little Sandy.)

Atic-a-make. See Atikameg.

Atik; river, tributary to Migiskan river, below Millie lake, Pontiac county, Que. (Not Atikosipi.)

Atikameg; lake, western Manitoba. (Not Atic-a-make.)

Atikamek. See Lamy.

Atikkamek; creek, tributary to Iosegun river, Alberta. (Not Atikkamey.)

Atikmahik. See Beaudry.

Atikonak; lake and river, near height of land, south of Hamilton river, Ashuanipi territory, Que. (Not Attikonak.)

Atikosipi. See Atik.

Atikwa; lake, southwest of Dryberry lake, Kenora district, Ont. (Not Deer.)

Atim; river, flowing into Manuan lake, upper St. Lawrence river, Champlain county, Que. (Not Atem.)

Atlin; lake, Cassiar district, B.C. and Yukon.

Atlin; mining division and mountain, Cassiar district, B.C.

Atocas. See Azatika.

Attawapiskat; lake and river, emptying into James bay, Patricia district, Ont. (Not At-tah-wha-pis-kat nor Attawapiscat.)

Attikonak. See Atikonak.

Attim Segoun. See Iosegun.

Attitti; lake, south of Churchill river and east of Pelican narrows, Sask.

Aubrey; island, Admiralty group, St. Lawrence river, Leeds county, Ont. (Not Burnt, Dark, nor Smoke.)

Augustine; peak, in the Bishops range of the Selkirks, Kootenay district, B.C.

Aukpatuk; fishing station, west coast of Ungava bay, New Quebec. (Not Akpatok.)

Aulac; river, emptying into Cumberland bay, Westmorland county, N.B. (Not Au Lac nor Oulac.)

Ausable; river, south of Goderich, Huron county, Ont. (Not aux Sables nor Sable.)

Austerity; glacier and mountain, Adamant range, Selkirk Mts., Kootenay, B.C.

Austin; lake, Melick township, Kenora district, Ont.

Australia; creek, tributary to Indian river, Yukon.

Autaca. See Azatika.

Ava; inlet, north shore of Hudson strait, N.W.T.

Avalanche; creek, glacier, and mountain, Selkirk mountains, Kootenay district, B.C.

Avens; mount, east of Protection mountain, Rocky mountains, Alta.

Awillgate; Indian village, also peak, east of Hazelton, Cassiar district, B.C. (Not Ahwillgate.)

Axel Heiberg; island, west of Ellesmere island, N.W.T.

Axeman; island, Lake Fleet group, St. Lawrence river, Leeds county, Ont.

Ayesha; peak, north of mount Collie, Rocky mountains, Kootenay district, B.C.

Aylen; lake, Dickens township, Nipissing district, Ont. (Not Little Opeongo.)

Aylmer; mount, also canyon, north of Minnewanka lake, Rocky Mts. park, Alta.

Aylmer; lake, Wolfe county, Que.

Aylmer; railway station and town, Ottawa county, Que. (Not Aylmer East.)

Aylmer; town, Elgin county, Ont.

Aylmer; township, Frontenac county, Que.

Azatika; bay and brook, Prescott county, Ont. (Not Atocas, Autaca, Dez Amecane nor Deseticaux.)

Azimuth; mountain and peak, north of mount Sir Sandford, Selkirk mountains, Kootenay district, B.C.

B

Babine; mountain range, lake, and river tributary to Skeena river, Cassiar and Coast districts, B.C.

Bach; mount, in southwestern Yukon, near Hutshi lakes.

Bachewanaung. See Batchawana.

Back. See Prairies.

Backs; river, flowing northeasterly into the Arctic ocean, N.W.T. (Not Thleweechodeezeth nor Great Fish.)

Back's Western. See Western.

Bacon; cove and point, on north side of Prince Rupert harbour, Coast district, B.C.

Bacon; rock, west of Ridley island, S.E. of entrance to Prince Rupert harbour, B.C.

Bacon. See Vigilant.

Bad. See Bull.

Badesdawa; lake, north of L. St. Joseph, Patricia district, Ont.

Bad Neighbour; rock in main channel entrance to Georgian bay, Bruce Co., Ont.

Bad Rice. See Kaiashkomin.

Bad Throat. See Manigotagan.

Baffin; island, N.W.T. (Not Baffin Land.)

Bagheera; mountain, Hermit range of the Selkirks, Kootenay district, B.C.

Bagot; island, northeast of Grenadier island, St. Lawrence river, Leeds county, Ont. (Not Narrow nor Rattlesnake.)

Bagutchuan. See Pagwachuan.

Bagwah. See Lonely.

Baie des Chaleurs. See Chaleur bay.

Baie-St.-Paul; town, Charlevoix county, Que. (Not St. Paul's Bay.)

Baie-Verte; village, Westmorland county, N.B. (Not Bay Verte.)

Bailey; lake, south of L. Seul, Kenora district, Ont. (Not Edith.)

Bain; brook, tributary to Incomappleux river, Kootenay district, B.C.

Bain; rock, in middle of channel between Great and Outer Duck islands, Manitoulin district, Ont.

Bakado; lake, south of Separation lake, Kenora district, Ont.

Baker; creek and lake, north of Eldon station, Rocky mountains, Alta.

Baker; creek, tributary to Yukon river, south of Klondike river, Yukon.

Baker; island, between Nigger island and Trenton, Hastings county, Ont.

Baker; mount, south of Howse pass, Rocky mountains, B.C.

Balache; point, in the strait of Canso, Inverness county, N.S. (Not Belache, Belhache, McMillan, nor Plaster Cove point.)

Bald; head, at entrance to Weller bay, Prince Edward county, Ont.

Bald; creek, headwaters of Klondike river, Yukon.

Bald; island, in Weller bay, Ameliasburg township, Prince Edward county, Ont.

Bald; mountain, east of Sir Donald range of the Selkirks, Kootenay district, B.C.

Bald Eagle; lake, on Grass river, Manitoba.

Baldur; mount, west of Upper Arrow lake, Kootenay district, B.C.

Baldwin's pond. See Lyster lake.

Balfour; mount, also glacier and pass, Rocky mountains, Alta. and B.C.

Ball, lake; English river, Kenora district, Ont.

Ballantyne; bay and river, Deschambault lake, central Saskatchewan.

Ballenas; channel and island, strait of Georgia, New Westminster district, B.C. (Not Ballinac.)

Ballinac. See Ballenas.

Balne; lake, south of Silver lake, Kenora district, Ont.

Baltimore. See Irving.

Bamaji; lake, Cat river, west of L. St. Joseph, Patricia district, Ont. (Not Bamajigma nor Cross.)

Banfield; creek, emptying into Barkley sound, Vancouver I., B.C. (Not Bamfield.)

Banks; island N.W. of Victoria I., N.W.T. (Not Bank's Land, nor Baring Land.)

Banner; settlement, Oxford North township, Oxford county, Ont.

Bannock; burn, tributary to Little Slocan R., Kootenay, B.C. (Not Bannock creek.)

Bannock; point, at north end of Upper Arrow lake; Kootenay district, B.C.

Baptist; harbour, lake, and rock, southeast of cape Hurd, Bruce county, Ont.

Baptiste; creek and lake, west of Athabaska town, central Alberta.

Baptiste; lake, Herschel township, Hastings county, Ont. (Not Kaijick Manitou.)

Baptiste; river, tributary to the Saskatchewan, central Alberta.

Barbara; lake, southeast of L. Nipigon, Thunder Bay district, Ont. (Not Gull.)

Barber; lake, in McGarry township, Timiskaming district, Ont.

Barbue; post office, Rouville county, Que. (Not Barbue de St. Césaire.)

Barbue de St. Césaire. See Barbue.

Barclay; railway station, Kenora district, Ont.

Barclay. See Barkley.

Barge; island, Lake Fleet group, St. Lawrence river, Leeds county, Ont.

Barham; mount, west of Surprise lake, Cassiar district, B.C.

Baring. See Banks.

Bark; lake, Jones township, Renfrew county, Ont.

Barkley; sound, on the northwest coast of Vancouver island, B.C. (Not Barclay.)

Barnaby; railway station, river, and village, Northumberland county, N.B. (Not Barnaby River P.O.)

Barnard; lake, northwest of Sturgeon lake, Thunder Bay district, Ont.

Barnes; bay, north shore of Okisollo channel, Coast district, B.C.

Barnes; creek, tributary to Whatshan river, Kootenay district, B.C.

Barney; river, Pictou county, N.S. (Not Barney's.)

Barney River; post office, Pictou county, N.S. (Not Barney's River.)

Barnston; lake, English river, Kenora district, Ont.

Barnston pond. See Lyster lake.

Barrel. See Keg.

Barren; brook, south of Eagle lake, Kenora district, Ont.

Barrett; ledges, east side Brandypot channel, St. Lawrence R., Temiscouata Co., Que.

Barrett; reef, southeast of Milton bank, Bruce county, Ont.

Barrett; rock, east of entrance to Prince Rupert harbour, Coast district, B.C.

Barrette; lake, Methuen township, Peterborough county, Ont.

Barrie: beach, east entrance Halifax harbour, Halifax Co., N.S. (Not Stony.)

Barrie; lake, Redditt township, Kenora district, Ont.

Barrière; lake, an expansion of the upper Ottawa river, Pontiac county, Que.

Barrington; lake, northwest of Kawaweogama lake, Thunder Bay district, Ont.

Barrington Passage; village, on the west side of Barrington bay, at the narrows, Shelburne county, N.S. (Not West Passage.)

Barrington; town, on the east side of Barrington bay, near its head, Shelburne county, N.S.

Barron; river, tributary to Petawawa river, Renfrew county, Ont. (Not South Branch of Petawawa nor South Petawawa.)

Bartibog; P.O., river, and railway station, Gloucester county, N.B. (Not Bartibogue.)

Barwell; mount, between the upper waters of Fisher creek and Sheep river, Alta.

Basin; lake, northwest of Lenore lake, central Saskatchewan.

Basin of Mines. See Minas basin.

Basket; lake, south of Minnitaki lake, Kenora district, Ont.

Bason. See Bouleau.

Basquia. See Pasquia.

Bass; islands (3), Admiralty group, St. Lawrence river, Leeds county, Ont. (Not Seven Pines.)

Bass. See Asheigamo.

Bass. See Cassidy.

Bass. See Jacob.

Basswood; lake, Int. boundary, Rainy River district, Ont. (Not Whitewood.)

Bastion; island, in southern portion of Atlin lake, Cassiar district, B.C.

Bastion; mountains, north of Salmon arm (Shuswap L.), Kamloops district, B.C.

Batchawana; bay, island, river, and village, Algoma district, Ont. (Not Bachewanaung nor Batchewana.)

Bath; creek and glacier, near Stephen station, Alta. (Not Noores.)

Bathing. See Royal.

Bathurst; island, east of Melville island, N.W.T.

Bathurst. See Grenadier.

Battersby; island, Brock group, St. Lawrence R., Leeds Co., Ont. (Not Burntstone.)

Battle; brook, tributary to Incomappleux river, Kootenay district, B.C.

Battle; lake, on Battle river, Alberta. (Not Battle River lake.)

Battle; mountain, west of Alexis creek, Cariboo district, B.C.

Battle; river, flowing into the Saskatchewan at Battleford, Alta. and Sask.

Battleford; town, central Saskatchewan.

Baudet; river, Glengarry county, Ont., also post village and river, Soulanges county, Que. (Not Beaudet, Bôdet, Rivière Beaudette nor River Beaudette.)

Baumgardt; island, at entrance to Landon bay, St. Lawrence river, Leeds county, Ont.

Baxter; river, emptying into Waswanipi lake, Abitibi territory, Que.

Baxter Harbour; post office, Kings county, N.S. (Not Baxter's Harbour.)

Bayfield; bay, Wolfe island, Frontenac county, Ont. (Not Big.)

Bayfield; island, at entrance to Bayfield bay, Wolfe island, Frontenac county, Ont. (Not Mud.)

Bayfield; river and town, Huron county, Ont.

Bayfield; shoal, west of Abraham head, east of Kingston, Frontenac county, Ont. (Not Bolivia.)

Bayley; bay, eastern extreme of Basswood lake, international boundary, Rainy River district, Ont.

Baynes. See Maxwell.

Bays; lake of, Ridout township, Muskoka district, Ont.

Bayside; post village, Sidney township, Hastings county, Ont.

Bay Verte. See Baie-Verte.

Bazan; bay, north of Cordova channel, Vancouver island, B.C.

Beacon. See Inukshuktuyuk.

Beady; creek, near outlet of Dease lake, Cassiar district, B.C.

Beament; island, southeast of Cavalier island, Bruce county, Ont.

Bear; creek, tributary to Klondike river, Yukon.

Bear; river, Annapolis and Digby counties, also Bear River post office, Digby county, N.S. (Not Hébert.)

Bear; river, flowing into the upper end of Portland canal, Cassiar district, B.C.

Bear. See Bowron.

Bear. See Darlens.

Bear. See Great Bear.

Bear. See Lorrain.

Bear. See Mansfield.

Bear. See Maskwa.

Bear. See Morin.

Bear. See Mistaya.

Bear. See Suskwa.

Bear. See Wapawekka.

Bearbrook; post office, Russell county, Ont. (Not Bear Brook.)

Bear-grease; river, upper Ottawa river, near O'Sullivan lake, Montcalm county, Que.

Bear Lake river. See Deschambault.

Bearwood; lake, Brudenell township, Renfrew county, Ont.

Beaton; mount, on boundary line, in great bend of Tatshenshini river, Cassiar district, B.C. and Yukon.

Beatrice; cape, E. side of Lower Arrow L., Kootenay district, B.C. (Not cape Horn.)

Beatrice; lake, west of Slocan lake, Kootenay district, B.C.

Beatty; point, in upper portion of Prince Rupert harbour, Coast district, B.C.

Beaubien; lake, east of Silver lake, Kenora district, Ont.

Beauchamp; lake, Figuery, Trécesson and Villemontel townships, Timiskaming county, Que. (Not Spirit.)

Beaudry; lake, Beaumesnil township, Timiskaming county, Que. (Not Atikmahik.) Previous decision revised.

Beaufils (anse à); bay, Percé township, Gaspe county, Que. (Not Bonfils.)

Beaumont; harbour, north shore of Hudson strait, N.W.T.

Beaupré; creek, tributary to Bow river, Alberta.

Beaurivage; island, Admiralty group, St. Lawrence river, Leeds county, Ont. (Not Buck's.)

Beaver; creek, crossing the international boundary and flowing northeasterly to White river, Yukon.

Beaver; glacier, mountain, and river, Selkirk mountains, Kootenay district, B.C.

Beaver; lake, south of Atlin lake, Cassiar district, B.C.

Beaver; river, tributary to Churchill river, central Alberta and Saskatchewan.

Beaver. See Beaverdell.

Beaver. See Beaverhill.

Beaver. See McFarlane.

Beaverdam. See Castor.

Beaver-dam. See Wuskwatim.

Beaverdell; creek, tributary to west fork of Kettle river, also village, Similkameen district, B.C. (Not Beaver creek.)

Beaverfoot; range of mountains and river, near Leanchoil sta., Kootenay dist., B.C.

Beaverhill; creek and lake, east of Edmonton, Alberta. (Not Beaver.)

Beaverhouse; lake, McVittie township, Timiskaming district, Ont.

Beaverhouse; lake, southwest of Eagle lake, Kenora district, Ont.

Beaverlodge; river, tributary to Wapiti river, west of Grande Prairie, Alberta. (Not Beaver Lodge.)

Beavertail. See Amiskwi.

Becaguimec; lake and river, Carleton and York counties, N.B. (Not Beccaguimec nor Peckagomique.)

Bécancour; lake, Thetford township, Megantic county, Que.

Becher; bay, southern coast of Vancouver island, B.C. (Not Beecher.)

Beck; island, west of Stone island, Clayoquot sound, Vancouver island, B.C.

Becker; creek, tributary to Wheaton river, southern Yukon.

Beckington; lake, southeast of Harris lake, Thunder Bay district, Ont.

Becroft; point, at south entrance to Weller bay, Prince Edward county, Ont.

Beddingfield. See Malahat.

Bedford; harbour, north shore of Hudson strait, N.W.T.

Bedlington; custom house, Int. boundary, Kootenay district, B.C. (Not Rykerts.)

Bedrock; creek, tributary to Sixtymile river, Yukon.

Bee; peak, east of Taku arm, Cassiar district, B.C.

Beech; point, Fitzwilliam island, Manitoulin district, Ont.

Beecher. See Becher.

Beech Hill; post office, Albert county, N.B.

Beechridge; post village, Argenteuil county, Que. (Not Beech Ridge.)

Beechwood; village and railway station, Carleton county, N.B. (Not Bunfrau.)

Beechy; head, southern coast of Vancouver island, B.C.

Beeghados. See Pachena.

Beekman; peninsula, south of entrance to Cumberland sound, N.W.T.

Begbie; mount, southwest of Revelstoke, Kootenay district, B.C.

Belabourer; island, Lake Fleet group, St. Lawrence river, Leeds county, Ont.

Belache. See Balache.

Bela Kula. See Bellakula.

Bélanger; bay and point, near Girouard point, Manitoulin district, Ont. (Not West Belanger.)

Bélanger; post office, Laval county, Que. (Not Village Bélanger.)

Bélanger; river, flowing into L. Winnipeg, Manitoba. (Not Black nor Little Black.)

Belas. See Lepreau.

Belcher; mount, Saltspring island, southeast coast of Vancouver island, B.C.

Belhache. See Balache.

Bell; mount, south of Wheaton river, southern Yukon.

Bell; river, flowing from the height of land near Grand lake Victoria and emptying into Mattagami lake, Abitibi and Timiskaming, Que.

Bellabella; settlement, on Campbell island, Coast district, B.C. (Not Bella Bella.)

Bellakula; river and settlement, Coast district, B.C. (Not Bela Kula, nor Bella Coola.)

Bellefeuille; river, flowing from Robertson lakes to Makamik lake, Timiskaming county, Que. (Not Kakameonan.)

Belle-Vallée; village, St. Johns county, Que. (Not Belle Vallée nor Bellevalle.)

Belliveau; cove and village, Digby county, N.S. (Not Belliveau Cove village nor Belliveaux Cove village.)

Belliveau; creek, tributary to Petitcodiac river, Westmorland county, N.B. (Not Belle Vue nor Boyd.)

Belliveau; village, Westmorland county, N.B. (Not Beliveau.)

Bellmay; post village and railway station, Leeds county, Ont. (Not Bellmay's.)

Bells Corners; post village and Ry. station, Carleton Co., Ont. (Not Bell's Corners.)

Belly. See Mokowan.

Belmina; post village, Wolfestown township, Wolfe county, Que.

Beloeil. See St. Hilaire.

Bending; lake, at head of Big Turtle river, Kenora district, Ont.

Bennett; lake, B.C. and Yukon.

Bennett; mount, northwest of Stupart bay, Hudson strait, New Quebec.

Benson; creek, tributary to the north fork of Klondike river, Yukon.

Benson; lake, in Skead township, Timiskaming district, Ont.

Benson; mount, west of Nanaimo, Vancouver island, B.C.

Benson; point, South bay, Manitoulin island, Manitoulin district, Ont.

Bent; lake, east of Tawatinaw lake, Kenora district, Ont.

Bentinck; island, south of Pedder bay, Vancouver island, B.C.

Berens; H. B. Co.'s post, also island and river, E. of L. Winnipeg, Man. (Not Beren's.)

Bergheim; settlement, in Tp. 37, R. 3, W. 3 M., Sask.

Bernard; lake, south of Bennett lake, Cassiar district, B.C.

Berney; creek, tributary to Wheaton river, southern Yukon.

Berry; lake, north of Lobstick bay, Kenora district, Ont.

Berry Mills; post village and railway station, Westmorland county, N.B. (Not Berry's Mills.)

Bersimis; point, river, and village, Saguenay county, Que. (Not Betsiamits.)

Best. See Hatton.

Betsiamits. See Bersimis.

Biart; lake, Biart township, Quebec county, Que. (Not Kamilikamac.)

Biddle; mount, south of mount Lefroy, Rocky mountains, Kootenay district, B.C.

Biddle; pass, between Mt. Biddle and Park mountain, Yoho park, Rocky mts., B.C.

Bident; mountain, east of mount Fay, Rocky mountains, Kootenay district, B.C.

Big; bay and island, in the bay of Quinte, Prince Edward county, Ont. Big Island post office is on the north side of the island.

Big. See Bayfield.

Big. See Black.

Big. See Dumoine.

Big. See Edgett.

Big. See Hecla.

Big. See Koksoak.

Big. See Merigomish.

Big. See Skelton.

Big Black. See Hecla.

Big Cutarm. See Cutarm.

Big Egg. See Missawawi.

Bigelow; island, Weller bay, Prince Edward county, Ont.

Bighill; creek, tributary to Bow river, Alta.

Bighorn; mountain range, extending from Brazeau river to the Saskatchewan, also river tributary to the Saskatchewan, Alta. (Not Big Horn nor Big-horn.)

Big Knife; portage, between Seed and Melon lakes, international boundary, Rainy River district, Ont.

Big Loran. See Lorembec.

Big Lorraine. See Lorembec.

Big Obashing. See Obashing.

Big or North Miminigash. See Miminegash.

Big Otter; creek, flowing into lake Erie, Elgin county, Ont. (Not Otter.)

Big Otter Creek (lightstation) See Port Burwell.

Big Port l'Hebert. See Port Hebert.

Big Quill. See Quill.

Big Reed. See Kiskittogisu.

Big Rock. See Inukshiligaluk.

Big Rouge creek. See Rouge river.

Big Saanich. See Wark.

Big Salmon; river, tributary to Lewes river, Yukon.

Big Sandy. See Wellington.

Bigsby; island, at entrance to Key harbour, Georgian bay, Parry Sound district, Ont.

Big Stave. See Stave.

Big Sturgeon. See Torch.

Big Thrumcap; island at entrance to Halifax harbour, Halifax county, N.S.

Billtown; post settlement, Kings county, N.S. (Not Bill Town.)

Binbrook; township and village, Wentworth county, Ontario. (Not Binbrooke.)

Bingham; island, southwest of Lynedoch island, St. Lawrence river, Leeds county, Ont. (Not Binghan.)

Birch; brook and lake, Burntwood river, Manitoba.

Birch; lake, between Basswood and Carp lakes, international boundary, Rainy River district, Ont.

Birch; point, east of Walker point, Manitoulin district, Ont.

Birch. See Dozois.

Birch. See Evelyn.

Birch. See Wigwasikak.

Birchbark; lake, south of Candle lake, central Saskatchewan. (Not Birch Bark.)

Bird; creek, branch of Ophir creek, Indian river, Yukon.

Bird. See Ciboux.

Bird. See Oiseau.

Birds Hill; post village and railway station, northeast of Winnipeg, Man. (Not Bird's Hill.)

Birdtail; creek, tributary to Assiniboine river, western Manitoba.

Birkby; point N.W. pt. Greaves I., Smith sound, Coast district, B.C. (Not Birkly.)

Birkenhead; river, flowing into Lillooet river, above Lillooet lake, B.C.

Birtle; town, on Birdtail creek, western Manitoba. An abbreviation of the creek name.

Bisby; lake and river, Megantic and Wolfe counties, Que.

Bisel; mount, west of Nordenskiöld river, Yukon.

Bishop; cove, Boxer reach, Coast district, B.C.

Bishop; island, off the south end of Kaien island, Coast district, B.C.

Bishop; island, at head of Frobisher bay, N.W.T.

Bishop; post village, Grenville county, Ont. (Not Bishop's Mills.)

Bishop's Mills. See Bishop.

Bishop Roggan. See Roggan.

Bismarck; post office, Lincoln Co., Ont., and Ponoka district, Alta. (Not Bismark.)

Bizard; island, St. Lawrence river, Jacques Cartier county, Que.

Bjerre; rock, in Okisollo channel, north of Lake point, Coast district, B.C.

Björk; lake, on Red Deer river, eastern Saskatchewan.

Black; creek, tributary to Sloko river, Cassiar district, B.C.

Black; island, northeast of Heela island, lake Winnipeg, Man. (Not Big nor Grand.)

Black; lake, also Black Lake, railway station and village, Megantic county, Que.

Black. See Bélanger.

Black. See Garry.

Black. See Lynn.

Black. See Raisin

Blackbird. See Seggemak.

Black Charlie. See Sheaffe.

Black Douglas; the northerly peak of Mt. Douglas, Rocky mountains, Alta.

Black Duck Run. See Harbour lake.

Blackfeet. See Acheninni.

Blackfish; bay, Radcliffe township, Renfrew county, Ont.

Blackfoot; coulée and hills, north of Battle river, eastern Alberta.

Blackfox; bend, Pelly river, near Ketza river, Yukon.

Blackfriars; peaks (2) southwest of Adamant mountain, Selkirk mountains, Kootenay district, B.C.

Blackheath; post office, Wentworth county, Ont. (Not Black Heath.)

Black Iron. See Blackstone.

Blackney. See Blakeney.

Blacks; point, south of Goderich, Huron county, Ont.

Black Sawbill. See Kinnickoneship.

Blackstone; tributary to the south branch of Brazeau river, central Alberta.

Blackstone; lake on Cat R., W. of L. St. Joseph, Patricia, Ont. (Not Black-iron.)

Black Sturgeon; bay, lake and river, lake Nipigon, Thunder bay district, Ont.

Blackwater; creek, lake, mountain, and range of mountains, south of Bush river, Rocky mountains, Kootenay district, B.C.

Blackwater; river, tributary to Fraser river, above Quesnel, Cariboo and Coast districts, B.C. (Not Black river, nor West Road river.)

Blackwell; railway station, Lambton county, Ont. (Not Blackwall.)

Blaeberry; river, tributary to Columbia river, between Donald and Moberly stations, Kootenay district, B.C. (Not Blueberry.)

Blaine; lake, southwest of Carlton, central Saskatchewan.

Blake; point, S.E. end of W. Duck island, Manitoulin district, Ont. (Not Stony.)

Blakeney; passage, between Hanson, Cracroft and Harbledown islands, Broughton strait, Coast district, B.C. (Not Blackney.)

Blakiston; brook, tributary to Waterton R., Alta. (Not Kootanie nor Pass creek.)

Blakiston; mount, Tp. 2, R. 1, W. 5, M., southern Alberta.

Blanchard; river, tributary to Tatshenshini R., Cassiar district, B.C. and Yukon.

Blanchard. See Blanshard.

Blanche; river, emptying into the head of L. Timiskaming, Timiskaming dist., Ont.

Blanford; bay, north shore of Hudson strait, N.W.T.

Blanshard; mount, southeast of Pitt lake, New Westminster district, B.C. (Not Blanchard nor The Golden Ears.)

Blind. See Chematogan.

Blind. See Coldwater.

Blinkhorn; mount, west of Parry bay, Vancouver island, B.C.

Bloodletter; island, Lake Fleet group, St. Lawrence river, Leeds county, Ont.

Bloodvein; river, emptying into east side of L. Winnipeg, Man. (Not Blood Vein.)

Bloomfield; island, off the southeast side of Grenadier island, St. Lawrence river, Leeds county, Ont. (Not Snake.)

Blouin. lake, Bourlamaque and Senneville townships, Timiskaming county, Que. (Not Pakitanika.)

Blue; river, tributary to Dease river, Cassiar district, B.C.

Blue. See Harris.

Blueberry. See Mennin.

Blueberry. See Blaeberry.

Blue Grouse; creek, tributary to Caribou creek, Kootenay district, B.C.

Blue Hills of Brandon. See Brandon hills.

Blue Jay; creek, flowing into Michael bay, Manitoulin I., Manitoulin district, Ont.

Bluff; island, Admiralty group, St. Lawrence river, Leeds county, Ont.

Bluff; mountain, west of Sooke river, Vancouver island, B.C.

Bluff; mountain, north of Frank, southwestern Alberta.

Bluff. See De Rottenburg.

Bluff. See O'Neil.

Bluff. See Yeo.

Bluffy; lake, on Wenisaga river, northwest of L. Seul, Patricia district, Ont. (Not Kah-mini-ti-gwa-quiack.)

Blunt; peninsula, at entrance to Frobisher bay, N.W.T. (Not Blunt's.)

Bobbie Burns; mount, west of the southern end of Mabel lake, Osoyoos dis., B.C.

Bobtail. See Naltesby.

Bodega; point, south of Granite point, Quadra island, Coast district, B.C.

Bodet. See Baudet.

Bolger; lake, Burleigh township, Peterborough county, Ont. (Not Bolger's.)

Bolivia. See Bayfield.

Bonald; lake, on Churchill river, Sask. (Not Moose.)

Bonanza; creek, tributary to Klondike river, Yukon.

Bond-Head; post village, Simcoe county, Ont. (Not Bondhead.)

Bonfils. See Beaufils.

Bonnet; island, off northwest side of Flathead island, Thunder Bay district, Ont. (Not Reef.)

Bonney; island, north shore of Hudson strait, N.W.T.

Bonney; mount, also glacier and névé, Selkirk mountains, Kootenay district, B.C.

Boofus; mount, north of Gladys lake, Cassiar district, B.C.

Boom; lake and mountain, northwest of Storm mountain, Rocky mountains, Alta.

Boom; point, southern point of Cockburn island, Manitoulin district, Ont.

Booth; bay, east coast of Saltspring island, S.E. coast of Vancouver island, B.C.

Booth; creek, tributary to St. Mary river, Kootenay district, B.C.

Bor; a peak of the Valhalla mountains, Kootenay district, B.C.

Bosanquet; harbour, Big island, Hudson strait, N.W.T.

Boshkung; lake, Stanhope township, Haliburton county, Ont.

Boss Dick. See Yorke.

Boswell; mount, also river, Teslin river, Yukon.

Bosworth; mount, northwest of Stephen station, Kootenay district, B.C.

Botsford; lake, northeast of Minnitaki lake, Kenora district, Ont.

Bottle; portage, between Iron and LaCroix lakes, international boundary, Rainy River district, Ont.

Bouchette; lake, an expansion of the upper Ottawa river, Montcalm county, Que.

Bouchier; island, Navy group, St. Lawrence river, Leeds county, Ont. (Not Bouchie.)

Bouckhill; post office, Dundas county, Ont. (Not Bouck's Hill.)

Boularderie; island, Victoria county, N.S. (Not Boulardine nor Boulardarie.)

Boulder; creek, tributary to Kicking Horse river, Kootenay district, B.C.

Boulder; creek, branch of Bonanza creek, Klondike river, Yukon.

Boulder. See Nares.

Boulder. See Opabin.

Boulder. See Osipasinni.

Boulder. See Sharpe.

Bouleau; river, Saguenay county, Que. (Not Bason.)

Bouleau. See Cedars.

Boulter; lake, McClure township, Hastings county, Ont.

Boundary; bay, on international boundary, New Westminster district, B.C.

Boundary; cove, between Du Vernet and Dundas points, northeast of Digby island, Coast district, B.C.

Boundary; creek, flowing into Yukon river at the crossing of the international boundary, Yukon.

Boundary; creek, flowing into Kettle river, Similkameen district, B.C.

Boundary; mountains, international boundary, Kootenay district, B.C.

Bourgeau; mount, also range of mountains, Rocky mountains, Alberta.

Boutilier; cove, lake, and point; also Boutilier Point, P.O.; St. Margaret bay, Halifax county, N.S. (Not Boutillier.)

Boutillier. See Boutilier.

Bow; glacier, lake, pass, peak, and river, western Alberta. (Not Coldwater lake, Upper Bow lake, Coal mountain, nor Askow river.)

Bow; island, at junction of Belly, Bow and S. Saskatchewan rivers, S.E. Alberta.

Bow; range of mountains in the Rockies, Alta. and B.C.

Bow. See Hector.

Bowden; lake, south of Clay lake, Kenora district, Ont.

Bowdoin. See McLean.

Bowes. See Constance.

Bow Island; post office and railway station, southeastern Alberta.

Bowman; creek, west of Lower Arrow lake, Kootenay district, B.C.

Bowmanville; town, Durham county, Ont.

Bowron; lake and river, tributary to Fraser river, Cariboo district, B.C. (Not Bear.)

Bowsman; post office and railway station, also river tributary to Woody river, Man. (Not Bowsman River post office.)

Bowtree; lake and river, emptying into south side of lake LaRonge, Sask.

Boxer; reach, east of Gribbell island, Coast district, B.C.

Boyd. See Belliveau.

Boyer; lake, south of Dinorwic lake, Kenora district, Ont. (Not Saganaga.) (New name adopted to avoid duplication of Saganaga, the name of a well known lake on international boundary west of L. Superior.)

Boyer; reef, east of Belcher reef, Bruce county, Ont.

Boyer; river, tributary to Peace river, also settlement, Alta. (Not Paddle river.) Reversal of former decision.

Boyne. See Morris.

Brabant; island, Clayoquot sound, S.W. coast of Vancouver I., B.C. (Not Pender.)

Brachiopod; mountain, south of Ptarmigan lake, Rocky mountains, Alberta.

Brackendale; settlement, on Squamish river, New Westminster district, B.C.

Braden; mount, also creek, west of mount McDonald, Vancouver island, B.C.

Braeburn; mount, also lake, northwest of lake Laberge, Yukon.

Bramham; island, Queen Charlotte sound, Coast district, B.C. (Not Branham.)

Brandon; hills, south of Brandon, Man. (Not Blue hills of Brandon.)

Brandon; island, Departure bay, east coast of Vancouver island, B.C. (Not Double.)

Brandypot; bank, channel, and island, east of Hare island, St. Lawrence river, Charlevoix county, Que. (Not Brandy Pot nor Pot-à-l'eau-de-vie.)

Branham. See Bramham.

Brantnober; mount, in southwestern Yukon.

Bras d'Or; lake, the expanse between St. Peter inlet and Barra strait, with its bays; Cape Breton, Inverness, Richmond and Victoria counties, N.S. (Not Great Brass d'Or lake.) Previous decision revised.

Bratt; island, west of Georgina island, St. Lawrence river, Leeds county, Ont.

Bray; settlement and railway station, Russell county, Ont. (Not Bray's nor Bray's Crossing.)

Bray; reef, east of Ruel shoal, at entrance to Key harbour, Georgian bay, Parry Sound district, Ont.

Bray's Crossing. See Bray.

Brazeau; lake and river, tributary to the Saskatchewan, also mountain range, central Alberta. (Not Brazeau's.)

Brébeuf; island, in the southern portion of Georgian bay, Muskoka district, Ont. (Not Brébocuf.)

Breeches; lake, Garthby township, Wolfe county, Que.

Brenton; mount, north of Chemainus river, Vancouver island, B.C.

Brenton; railway station, Vancouver island, B.C. (Not Brenton's.)

Brereton; lake, north of Rennie, southeastern Manitoba.

Brett; mount, northwest of mount Bourgeau, Alberta.

Brevoort; island, east of Beekman peninsula, N.W.T.

Brew; mount, on south side of Cayoosh creek, Lillooet district, B.C.

Brewer; creek, tributary to Stewart river, above Scroggie creek, Yukon.

Brewery; creek, tributary to Wild Horse river, Kootenay district, B.C.

Brewster; creek and glacier, southwest of Banff, Kootenay district, B.C.

Brian. See Brine.

Bridge; island, N. of Broughton I., St. Lawrence R., Leeds Co., Ont. (Not Chimney.)

Bridge; river, flowing into Fraser river, above Lillooet, Lillooet district, B.C.

Bridgland; river, tributary to Thessalon river, Algoma district, Ont. (Not East branch of Thessalon river.)

Brier; island, at entrance to St. Mary bay, Digby county, N.S. (Not Bryer.)

Bright; lake, McClintock township, Haliburton county, Ont.

Brighton; township, in Northumberland county, Ont.

Brightsand; lake, Tps. 53 and 54, R. 20, W. 3 M., Sask. (Not Bright Sand.)

Brine; lake, east of St. Margaret bay, Halifax county, N.S. (Not Brian.)

Brinston; post village, Dundas county, Ont. (Not Brinston's Corners.)

Brinston's Corners. See Brinston.

Brion; island, Magdalen group, Gaspe county, Que. (Not Bryon, Byron, nor Cross.)

Brisco; range of mountains, between Columbia and Kootenay rivers, B.C.

Bristol. See Shemogue.

Britannia Bay; post village and summer resort, Carleton county, Ont. (Not Britannia-on-the-Bay.)

British; range of mountains, near the Arctic coast, crossed by international boundary, Alaska and Yukon.

Britton; mount, north of Tulameen river, Yale district, B.C.

Broadback; river flowing from the height of land near Mistassini lake, westerly through lake Evans to Rupert bay, Abitibi, Que. Includes the waters formerly named "Little Nottaway river," "Rapid river" and "Victoria river." Previous decision revised.

Broadwood; mount, east of Elko, Kootenay district, B.C.

Brock; group of islands, St. Lawrence river, west of Brockville, Leeds county, Ont. (Not Brock's.)

Brock; island, north of St. Lawrence island, Lake Fleet group, St. Lawrence river, Leeds county, Ont. (Not Squaw.)

Brockway; settlement, York county, N.B. (Not Brookway.)

Brodeur; island, south of Shesheeb bay, Thunder Bay district, Ont.

Brokenhead; river, flowing northerly into lake Winnipeg, also village, Man. (Not Broken Head.)

Brokenmouth; river, tributary to Nelson river, Manitoba. (Not Broken-mouth.)

Bronson; lake, south of Ministikwan lake, central Saskatchewan. (Not Grassy.)

Bronte; creek, railway sta. and village, Halton Co., Ont. (Not Twelve Mile creek.)

Brookway. See Brockway.

Broom; hill, west of Sooke harbour, Vancouver island, B.C.

Brotchie; ledge, at southeast entrance to Victoria harbour, B.C. (Not Brotchy.)

Broughton; island, N.E. of Grenadier I., St. Lawrence R., Leeds Co., Ont. (Not Corn.)

Broughton; shoals, off Broughton island, St. Lawrence river, Leeds county, Ont. (Not Corn island shoals.)

Brown Dome. See Marble Dome.

Brownie; lake, Smellie township, Kenora district, Ont.

Browns; creek, tributary to Fortymile river, near international boundary, Yukon. (Not Brown nor Brown's.)

Brown's. See Knapp.

Brownwater. See Coffee.

Bruce; harbour, north shore of Hudson strait, N.W.T.

Bruce; mount, Saltspring island, southeast coast of Vancouver island, B.C.

Bruce; river, west of Driftpile river, central Alberta.

Brucy's. See Brussy.

Bruins; pass, in the Hermit range of the Selkirks, Kootenay, B.C. (Not Bruin's.)

Brulé; point, Athabaska R., opp. mouth of Little Buffalo R., Alta. (Not Point Brulé.)

Brulé. See Grand.

Brush. See Sheaffe.

Brushy; creek, emptying into Christopherson lake, Timiskaming county, Que.

Brussy; point, on north side of île Perrot, Vaudreuil county, Que. (Not Brucy's.)

Bryant; creek, tributary to Yukon river, south of Klondike river, Yukon.

Bryce; mount, west of mount Alexandra, summit range of the Rockies, Alberta, and Kootenay district, B.C.

Bryer. See Brier.

Bryon. See Brion.

Buck; creek, tributary to Bulkley river, Cassiar district, B.C.

Buck; hill, north of Redflag mountain, Vancouver island, B.C.

Buckeye; shoal, south of Jenkins point, Manitoulin island, Manitoulin district, Ont.

Buckham; bay and point, Ottawa river, Torbolton township, Carleton county, Ont. (Not Buckham's nor Buckom.)

Buck-hill; river, tributary to Nipukatasi river, Abitibi territory, Que.

Buckley. See Bulkley.

Buck's. See Beaurivage.

Buffalo; lake, south of Battle river, Alberta. (Not Bull.)

Buffalo. See Mami.

Buffalo Pound; lake, north of Moosejaw, Sask. (Not Highpound.)

Buffer; lake, northwest of Howell, southern Saskatchewan.

Buisson; point, west of Melochville, Beauharnois county, Que. (Not Buisson's.)

Bukemiga; lake, west of lake Nipigon, Thunder Bay district, Ont.

Bulkley; river, tributary to Skeena river at Hazelton, Cassiar and Coast districts, B.C. (Not Buckley.)

Bull; river, tributary to Kootenay R., N. of Wardner, Kootenay dist., B.C. (Not Bad.)

Bull. See Buffalo.

Buller; reef, off the south shore of Manitoulin island, Manitoulin district, Ont.

Bullpound. See Hanalta.

Bull's Forehead; hill, opposite the mouth of Red Deer river, southern Saskatchewan.

Bumfrau. See Beechwood.

Bunker; hill, south of Braeburn lake, southern Yukon.

Buntzen; lake, east of the north arm of Burrard inlet, New Westminster district, B.C. (Not Trout.)

Burgess; mount, also pass, southwest of mount Field, Kootenay district, B.C.

Burgoyne; bay, Saltspring island, southeast coast of Vancouver island, B.C.

Burgoyne. bay, south shore of Hudson strait, New Quebec.

Burial; point, Sansum narrows, Stuart channel, S.E. coast of Vancouver island, B.C.

Burke; island, south of Reid point, Bruce county, Ont.

Burnet; lake, west of Kennabutch lake, Kenora district, Ont.

Burnham; creek, tributary to Dominion creek, Indian river, Yukon.

Burns; creek, tributary to Indian river, Yukon.

Burns; lake, on telegraph trail, south of Babine lake, Coast district, B.C.

Burnt; island, northerly from Inner Duck island, and separated from Manitoulin island by a very narrow channel, Manitoulin district, Ont. The south end of this island was called 'Peninsular point' by Admiral Bayfield.

Burnt; river, Haliburton and Victoria counties, Ont.

Burnt. See Aubrey.

Burnt Bay; lake, south of Grand lake Victoria, Pontiac county, Que.

Burnt Island; harbour, south shore of Manitoulin island, Manitoulin district, Ont.

Burnstone. See Battersby.

Burntwood; bay, south shore of L. Seul, Kenora district, Ont.

Burntwood; lake, and river tributary to Nelson river, Manitoba. (Not Wepiskow.)

Burrill; point, Active pass, strait of Georgia, New Westminster district, B.C.

Burritt Rapids; post village, Grenville county, Que. (Not Burritt's Rapids.)

Burton; creek, tributary to Klondike river, Yukon.

Burton; island, west of Berens island, lake Winnipeg, Man. (Not Little Black.)

Burton; town, on Columbia river, near north end of Lower Arrow lake, Kootenay district, B.C. (Not Burton City.)

Burveith; arm, Ladysmith harbour, east coast of Vancouver island, B.C.

Burwell; port, east shore of Ungava bay, New Quebec.

Bush; lake, peak, and river, northwest of Donald, Rocky Mts., Kootenay district, B.C.

Bush; mountain, between Watson and Wheaton rivers, southern Yukon.

Bush. See Renny.

Butler; bay, north of Cyrus Field bay, N.W.T.

Butler; lake, south of Wabigoon lake, Kenora district, Ont. (Not Kabitustigweiak.)

Button; islands, on south side of entrance to Hudson strait, New Quebec.

Butwell; peak, west of Garnet mountain, Yoho park, Rocky Mts., Kootenay dist., B.C.

Butze; point and rapids, between Morse basin and Shawatlan passage, east shore of Kaien island, Coast district, B.C.

Buzzard; lake, Burleigh township, Peterborough county, Ont.

Byron. See Brion.

C

Cabane. See Coban.

Cabano; railway station, river, township, and village, Temiscouata county, Que.

Cabin; creek, tributary to Flathead river, Kootenay district, B.C.

Cabistachuan. See Kabistachuan.

Cabri; lake, northeast of the mouth of Red Deer river, southern Saskatchewan.

Cache; bay, W. end of Saganaga lake, Int. boundary, Rainy River district, Ont.

Cache; lake, in Algonquin National park, Nipissing district, Ont.

Cacouna; island and village, Temiscouata county, Que.

Cactus; lake, southeast of Eyehill creek, Sask.

Cadman; point, west of Consecon, Weller bay, Prince Edward county, Ont.

Cadwallader; creek, tributary to south fork of Bridge river, Lillooet district, B.C.

Cahill; lake, west of Slocan lake, Kootenay district, B.C.

Cahnish. See Kanish.

Cain; point, Active pass, strait of Georgia, New Westminster district, B.C.

Cain; river, tributary to Miramichi river, Northumberland county, N.B. (Not Cain's nor Kains.)

Cain River; post village, Northumberland county, N.B. (Not Cain's River.)

Cairn; island and mountain, Richmond gulf, New Quebec.

Calder; lake, west of Manitou lake, Kenora district, Ont.

Calder. See Couldrey.

Caldwell; island, point, and shoal, Thunder Bay district, Ont. (Not Crystal island nor Grassy point.)

Caledon East; railway station and village, Peel county, Ont. (Not East Caledon.)

Caledonia; village, Guysborough county, N.S. (Not Middle Caledonia.)

Calete. See Kaiete.

Calf; creek, headwaters of Klondike river, Yukon.

Calf Pasture; point and shoal, Brighton township, Northumberland county, Ont.

Call Mill; settlement, Brome county, Que. (Not Calls Mills.)

Calvin Grove. See Kelvingrove.

Camden. See Campden.

Camelot; island, Lake Fleet group, St. Lawrence river, Leeds county, Ont. (Not Hog.)

Cameron; lake, northwest of Kakagi lake, Kenora district, Ont.

Cameron. lake, international boundary, southwestern Alberta.

Cameron; mountains, south of Taku arm, Cassiar district, B.C.

Camp; lake, Finlayson township, Nipissing district, Ont.

Campbell; creek, flowing westerly into Semiamu bay, New Westminster district, B.C. (Not Tahtaloo.)

Campbell; creek, tributary to Pelly river, Yukon. At the mouth of this stream is the site of Pelly Banks Post, abandoned in 1850.

Campbell; island, E. of Flatland I., Thunder Bay district, Ont. (Not Little Flatland.)

Campbell; island, Admiralty group, St. Lawrence R., Leeds Co., Ont. (Not Round.)

Campbell; mountains, N.W. of Dawson, also at upper waters of Laird river, Yukon.

Campbell; reef, southwest of Dorcas bay, Bruce county, Ont.

Campbell; river, tributary to Tobique river, from Trousers lake, Victoria county, N.B. (Not Right Hand Branch of Tobique river.)

Campbell; valley, west of Ice river, Kootenay district, B.C.

Campbell Cross; post village, Peel county, Ont. (Not Campbell's Cross.)

Campbellton; town, Restigouche county, N.B. (Not Campbell-town.)

Campden; post office, Lincoln county, Ont. (Not Camden.)

Campobello; island, N.W. of Grand Manan I., Charlotte Co., N.B. (Not Campo Bello.)

Campo Bello. See Welshpool.

Canaan. See New Canaan.

Canboro; post office, Haldimand county, Ont. (Not Canborough.)

Candle; lake, central Saskatchewan.

Canning; lake, Minden township, Haliburton county, Ont. (Not Canning's.)

Canoe; lake, in Algonquin National park, Nipissing district, Ont.

Canoe. See Kamongus.

Cañon; lake and river, tributary to Wabigoon river, Kenora district, Ont.

Canous. See Kanus.

Canouse. See Kanus.

Canrobert; post village and railway station, Rouville county, Que. (Not Ange Gardien de Rouville nor L'Ange Gardien East.)

Canterbury. See Invermere.

Cantin; shoal, southwest of St. Joseph, Huron county, Ont.

Canyon; creek, tributary to Dease river, also lake south of lake Lindeman; Cassiar district, B.C. (Not Deep.)

Canyon; creek, branch of Quartz creek, Indian river, and hill between lakes Laberge and Marsh, Yukon.

Canyon. See Ormonde.

Cap-à-l'Aigle; village, Charlevoix county, Que.

Cap Brûlé; lightstation, on cape of same name, below Cap Tormentine, Montmorency county, Que. (Not Montée du Lac.)

Cap Chat; lightstation and post office on cape of same name, also river and township, Gaspe county, Que. (Not Cap-de-Chate nor Cape Chatte.)

Cap-de-Chate. See Cap Chat.

Cap de Moselle. See Demoiselle.

Cape Chatte. See Cap Chat.

Cape of Hopes Advance. See Hopes Advance.

Cape Horn. See Pilot.

Cape Negro; island, at entrance to Negro harbour, Shelburne county, N.S. (Not Negro.)

Cape Negro Island; post office, on island of same name, Shelburne county, N.S.

Caplan; river, and Caplan River post office, Bonaventure county, Que. (Not Capelan.)

Caps (rivière des); river, flowing into the St. Lawrence below Fouquette river, Kamouraska county, Que.

Captain John's. See Foresters.

Caraquet; bay, parish, river, and village, Gloucester county, N.B. (Not Caraquette.)

Carbon; hill, south of Wheaton river, southern Yukon.

Carcajou; river, tributary to Kinojevis river, Timiskaming county, Que.

Carcross; post station, between Bennett and Nares lakes, southern Yukon. (Not Caribou nor Caribou Crossing.)

Cardinal's. See Arcand.

Cariboo; district, lake, and mining division, British Columbia. (Not Caribou.)

Cariboo. See Stevens.

Caribou; creek, tributary to Dominion creek, Yukon.

Caribou; creek and point, east of Columbia river, between the Arrow lakes, Kootenay district, B.C.

Caribou. See Carcross.

Caribou. See Keshkabuon.

Caribou. See Lawrence.

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Caribou. See Meachan.

Caribou. See Mudjatik.

Caribou Crossing. See Carcross.

Caribou Mines; post office, Halifax county, N.S. (Not Caribou Gold Mines.)

Carleton; lake, west of Manitou lake, Kenora district, Ont.

Carlsbad Springs; post office and railway station, Russell county, Ont. (Not Eastman's Springs.)

Carmack; a fork of Bonanza creek, Yukon.

Carmi; creek, tributary to west fork of Kettle river, also village at junction of the streams, Similkameen district, B.C.

Carnarvon; mount, northwest of Emerald lake, Rocky mountains, Kootenay district, B.C. (Not McMullen.)

Carnegie; island, north of Hill island, St. Lawrence river, Leeds county, Ont.

Caron; lake, Pettypiece township, Kenora district, Ont.

Caron; lake, Bellecombe, Claire and Vaudray townships, Timiskaming county, Que. (Not Crooked.)

Caron; point, east of Ste. Anne-de-Bellevue, Jacques Cartier county, Que.

Caron. See Carron.

Carp; lake and portage, W. of Knife lake, Int. boundary, Rainy River district, Ont.

Carp. See Lomond.

Carpenter; point, Wolfe island, Frontenac county, Ont. (Not Hinckley.)

Carr; railway station, Huntingdon county, Que. (Not Carr's Crossing.)

Carroll. See Macdonald.

Carroll Wood; bay, S. shore Manitoulin I. Manitoulin district, Ont. (Not Woods.)

Carron; point, at south entrance to Bathurst bay, Gloucester county, N.B. (Not Caron.) Previous decision reversed.

Carrot, river, tributary to Saskatchewan river, Man. and Sask. (Not Root.)

Carr's Crossing. See Carr.

Carrying Place; village, on the road of that name, Northumberland and Prince Edward counties, Ont.

Carson; lake, Jones township, Renfrew county, Ont.

Carson; post office, international boundary, Similkameen district, B.C.

Carter; bay, east of Jenkins point, Manitoulin district, Ont.

Carter; mount, east of Atlin lake, Cassiar district, B.C.

Carter; rock, west of Greene island and south of the west end of Manitoulin island, Manitoulin district, Ont.

Carthew; bay, northwestern shore of L. Simcoe, Simcoe Co., Ont. (Not Carthew's.)

Cartier; lake, Wylie township, Renfrew county, Ont.

Cartier; mount, east of Columbia river, Kootenay district, B.C.

Cartier; post office, Beauharnois county, Que. (Not Cartierville.)

Cartierville. See Cartier.

Carys Swan Nest; cape, Coats I., Hudson bay, N.W.T. (Not Cary's Swan Nest.)

Cascade; post village, on Kettle river, Similkameen district, B.C.

Cascade. See Coast.

Cascade. See O'Hara.

Cascumpeque; bay, Prince county, P.E.I. (Not Cascumpec nor Holland.)

Casey; cove, south of Pariseau point, Digby island, Prince Rupert harbour, Coast district, B.C.

Cassels; lake, Cassels and Riddell Tps., Nipissing district, Ont. (Not White Bear.)

Cassiar; a district of British Columbia.

Cassiar; bar, Lewes river, south of Big Salmon river, Yukon.

Cassiar; creek, tributary to Yukon river, above Fortymile, Yukon.

Cassiar; mountains, near upper waters of Liard river, B.C. and Yukon.

Cassidy; lake and railway station, S.W. of Cobalt, Timiskaming, Ont. (Not Bass.)

Cassidy; railway station, Vancouver island, B.C. (Not Cassidy's nor Cassidy Siding.)

Castle; mountain, north of Castle Mountain station, Rocky mountains, Alberta.

Castor and Pollux; peake, east of mount Bonney, Selkirk mountains, Kootenay district, B.C.

Castilian; shoal, southeast of Cockburn island, near entrance to Mississagi strait, Manitoulin district, Ont.

Castor; creek, tributary to Battle river, Alberta. (Not Beaverdam.)

Cat; lake and river, tributary to L. St. Joseph, Patricia, Ont. (Not Cat Lake river.)

Catamount; peak, in the Hermit range of the Selkirks, Kootenay district, B.C.

Cataract; brook, tributary to Kicking Horse river, near Hector station, Kootenay district, B.C. (Not Wapta creek.)

Cataract; peak, northeast of mount Molar, Rocky mountains, Alberta.

Cataract; rock, southwest of Porcupine point, Bruce county, Ont.

Cataract. See Cline.

Cataraqui; river, flowing into lake Ontario, at Kingston, Frontenac county, Ont. (Not Cataracquay, Cataraque, nor Great Cataraqui.)

Catch. See Ketch.

Catchacoma; lake, Cavendish township, Peterborough Co., Ont. (Not Ketchacum.)

Cathawhachaga. See Kathawachaga.

Cathedral; mountain, east of Mt. Stephen, Kootenay district, B.C. (Not Pinnacle.)

Catline. See Georgina.

Cat-tail; brook, tributary to Opichuan river, Thunder Bay district, Ont.

Cattle. See Cottle.

Causapscal; river and village, Matane Co., Que. (Not Casupscul nor Cosupscoult.)

Cavalier; island, southwest of Ghegheto island, Bruce county, Ont. (Not Gull.)

Cave; rock, in Yukon river, east of international boundary, Yukon.

Caven; creek, tributary to Gold creek, Kootenay district, B.C. (Not Middle nor South Fork of Gold creek.)

Cay-ke-quah-be-kung. See Kekkekwabi.

Cayoose. See Cayoosh.

Cayoosh; creek, tributary to Fraser river, at Lillooet, B.C. (Not Cayoose.)

Cedar; island, west of Massasauga point, bay of Quinte, Prince Edward county, Ont.

Cedar; island, east of the mouth of Cataraqui river, Frontenac county, Ont.

Cedar; lake, north of L. Winnipegosis, Manitoba.

Cedar. See Kishikas.

Cedars; island, rapids, and village, Soulanges county, Que. (Not Bouleau rapids.)

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Cegemecega. See Kejimkujik.

Cegoggin. See Chegoggin.

Celtis; lake, south of William bay, L. Seul, Kenora district, Ont.

Centrefire; lake, N.W. of Minnitaki lake, Kenora district, Ont. (Not Centre Fire.)

Centurion; mountain and glacier, northwest of Argentine mountain, Selkirk mountains, Kootenay district, B.C.

Chaba; river, tributary to Athabaska river, east of Fortress lake, Alberta.

Chabatok; Indian village, Kabistachuan bay, Mistassini lake, Mistassini territory, Q.

Chagoggin. See Chegoggin.

Chakwa; lake, at headwaters of St. Maurice river, Champlain county, Que.

Chaleur; bay, an inlet of the gulf of St. Lawrence, between Quebec and New Brunswick. (Not Bay of Chaleur nor Baie des Chaleurs, &c.) If the French form is used it is to be "Baie de Chaleur."

Chalk; bay, at mouth of Chalk river, also lake which is an expansion of the river near the bay, Buchanan township, Renfrew county, Ont. (Not Allumette bay nor Sturgeon bay and lake.)

Chalk River; post village and railway station, Renfrew county, Ont.

Chaloupe. See Shallop.

Chamberlain; island, north shore of Hudson strait, N.W.T. (Not Crete.)

Chambly; village, Chambly county, Que. (Not Chambly Basin.)

Champagne; island and point, east of Shipman point, St. Lawrence R., Leeds Co., Ont.

Champlain; point, south of Atherley, at northern end of lake Simcoe, Ontario Co. Ont.

Chancellor; peak, east of Leanchoil station, Kootenay district, B.C.

Chandindu; river, tributary to Yukon river, between Dawson and Cudahy, Yukon.

Channel; point, northeast side of Cockburn island, Manitoulin district, Ont.

Channel; rock, off northwest side of Fitzwilliam island, Manitoulin district, Ont.

Chantler; post office, Welland county, Ont. (Not Chantler's.)

Chantry; island, southwest of Saugeen river, Bruce county, Ont. The surrounding shoal bank is named after the island.

Chaperon; mountain, Blackwater range of the Rockies, Kootenay district, B.C.

Chapleau; lake, Tp. 14, Rgs. 10 & 11, W. 2 M. southwestern Saskatchewan.

Chaplin; lake and river, southern Saskatchewan (Not Old Wives.)

Charlebois. See Arcand.

Charles. island, in Hudson strait, New Quebec. (Not Katutok.)

Charles; point, west side of Prince Rupert harbour, Coast district, B.C.

Charlo; village, Guysborough county, N.S. (Not Charlo Cove nor Charlo's Cove.)

Charlo's Cove. See Charlo.

Charlotte; lake, Brudenell township, Renfrew county, Ont.

Charlton; bay, northeast of Leask point, Manitoulin island, Manitoulin district, Ont.

Charlton; mount, south of the narrows of Maligne lake, Rocky Mts., western Alberta.

Charwell; point, east of Peter lightstation, Prince Edward county, Ont. (Not Gull.)

Chartier; lake, south of Grand lake Victoria, Pontiac county, Que. (Not Wajabakoute.)

Chase; island, Frobisher bay, N.W.T.

Chase; railway station, Vancouver island ,B.C. (Not Chase River Crossing.)

Chase; river, south of Nanaimo, Vancouver island, B.C.

Chase River Crossing. See Chase.

Chassepot; rock, S. of Tremayne bay, southern coast of Digby I., Coast district, B.C.

Chateauguay. See Lalonde.

Chaudière; falls and portage, between Namakan and Rainy lakes, international boundary, Rainy River district, Ont. (Not Kettle.)

Chaudière. See Koochiching.

Cheakamus; river, tributary to Squamish river, New Westminster district, B.C.

Chebistuanonekau; river, upper waters of Waswanipi river, Abitibi territory, Que.

Chegoggin; point and post village, Yarmouth county, N.S. (Not Cegoggin nor Chagoggin.)

Chehalis; creek, flowing into Gladys bay, Cassiar district, B.C. (Not Che-halis.)

Chemainus; bay, lake, railway station, river, and village, in the southwest portion of Vancouver island, B.C. (Not Horse Shoe bay.)

Chemainus. See Kulleet.

Chematogan; channel, between Squirrel and Walpole islands, L. St. Clair, Lambton county, Ont. (Not Blind.)

Chemung; lake and post office, Peterborough Co., Ont. (Not Chemong nor Shemong.)

Cheney; post village and railway sta. Russell Co., Ont. (Not Cheney Station village.)

Cheney Station. See Cheney.

Chensagi; river, emptying into Gull lake Abitibi territory, Que. (Not Tshensagi.)

Cheops; mount, Selkirk mountains, Kootenay district, B.C.

Cherry; island, southeast of Dead island, at entrance to Key harbour, Georgian bay, Parry Sound district, Ont.

Cherry; lake, northwest of Lost lake, Kenora district, Ont.

Cherry; point, southeast of Cowichan harbour, Vancouver island, B.C.

Cherry. See Robert.

Cherry. See St. Helena.

Cherub; mountain, Selkirk range, Kootenay district, B.C.

Cheslatta; lake, south of Francois lake, Coast district, B.C. (Not Chestatta.)

Chetang; ridge, east of Mumm peak, Rocky mountains, Cariboo district, B.C.

Cheticamp; island, river, and town, Inverness county, N.S. (Not Chetican.)

Cheverie; creek and village, Hants county, N.S. (Not Chiverie.)

Chiblow; lake, in Montgomery and Scarfe townships, Algoma district, Ont. (Not Macoming.)

Chibougamau; lake and river, south of Mistassini lake, Abitibi territory, Que. (Not Chibougamou nor Chibougamoo.)

Chichester; island, northwest of Grenadier I., St. Lawrence river, Leeds county, Ont.

Chickens. See Kathlyn.

Chicot; river, Two Mountains county, Que. (Not Petit Chicot.)

Chidley; cape, at entrance to Hudson strait, New Quebec. (Not Chudleigh.)

Chief; island, near north end of lake Timiskaming, Timiskaming county, Que.

Chief Mountain. See Waterton.

Chiefs; island, Couchiching lake, Ontario county, Ont. (Not Chief.)

Chiefs; point, Amabel township, Bruce county, Ont.

Chieftain; hill, between Watson and Wheaton rivers, southern Yukon.

Chignecto; bay, between Cumberland county, Nova Scotia, and Albert and Westmorland counties, New Brunswick. (Not Chignecto channel.)

Chikobi; lake, Guyenne township, Timiskaming county, Que. (Not Chikobee.)

Chikoida; mountain and river, Nakina river, Cassiar district, B.C.

Chilako; river, trib. to Nechako R., Cariboo district, B.C. (Not Chilacco nor Mud.)

Chilanco. See Chilanko.

Chilanko; river, trib. to Chilcotin R., Cariboo and Coast districts, B.C. (Not Chilanco.)

Chilco. See Chilko.

Chilcote. See Chilko.

Chilcotin; lake, river, and village, Cariboo and Lillooet districts, B.C.

Childs; lake, in Duck Mountain Forest reserve, western Manitoba.

Chilko; lake and river, tributary to Chilcotin river, Cariboo, Coast, and Lillooet districts, B.C. (Not Chilco nor Chilcote.)

Chilliwack; lake, river, and town, in southern British Columbia. (Not Chilliwak, Chilliwhack, Chillukweyuk, nor Chiloweyuck.) Previous decision revised.

Chimney; creek, flowing into Fraser R., W. of Williams lake, Cariboo district, B.C.

Chimney. See Bridge.

Chimney Island (point). See Patterson.

Chimo. post, Koksoak river, New Quebec. (Not Fort Chimo.)

Chin; coulée and post office, southern Alberta.

China; butte, creek, and ridge, east of west fork of Kettle river, southern B.C.

China; cove and reef, near Wreck point, entrance to Georgian bay, Bruce Co., Ont.

China Hat. See Klemtu.

Chiniki; creek and lake, tributary to Bow river, also mountain, southern Alberta. (Not Chiniquy.)

Chinimicash. See Shinimikas.

Chip; lake, west of St. Ann, Alberta. (Not Dirt nor Lobstick.)

Chipewyan; H. B. Co.'s post, and Mission station, near outlet of Athabaska lake, also lake to southwest of Athabaska lake, Alta. (Not Chippawyan nor Chippewyan.)

Chipewyan; settlement, near southwesterly end of Athabaska lake, northeastern Alberta. (Not Fort Chipewyan.)

Chipman Corner; post office, Kings county, N.S. (Not Chipman Corners, Chipmans Corner nor Chipman's Corners.)

Chipooin. See Chipuin.

Chippawa; village, Welland county, Ont. (Not Chippewa.)

Chippewa. See Harmony.

Chippewa. See Welland.

Chipuin; mountain, Tp. 20, R. 27, W. 6 M., Kamloops district, B.C. (Not Chipooin.)

Chiputneticook; lakes, headwaters of St. Croix river, on western boundary of New Brunswick. (Not Chiputnecticook nor Chiputnaticook.)

Chisaouataisi. See Sassawatisi.

Chisholm; shoal, in Michael bay, S. shore of Manitoulin I., Manitoulin district, Ont.

Chismaina; lake, southeast of Teslin lake, Cassiar district, B.C.

Chitek; lake and river, emptying into Meadow lake, Sask. (Not Pelican.)

Chivelston; lake, south of Harris lake, Thunder Bay district, Ont.

Chiverie. See Cheverie.

Chlorydorme. See Cloridorme.

Choelquoit; lake, north of Chilko lake, Coast district, B.C.

Chonat; bay and point, S. shore Okisollo channel, Coast district, B.C. (Not Lake.)

Choniaban. See Sholiaban.

Choquette; bar, in Stikine R., N. of Iskut R., Cassiar district, B.C. (Not Choquette's.)

Chorkbak; inlet, north shore of Hudson strait, N.W.T. (Not Tchork-back.)

Chown; mount, about 25 miles northwest of Mt. Robson, Rocky mountains, Cariboo district, B.C.

Chrislers. See Crysler.

Christie; mount, also pass, watershed of Ross and Gravel rivers, N.W.T. and Yukon.

Christie; mount, southwest of Mt. Moberly and west of Athabaska river, Alta.

Christie Lake; post office, Lanark county, Ont. (Not Christy's Lake.)

Christina; bay, S. shore of Manitoulin I. and east of Burnt I., Manitoulin district, Ont.

Christina; lake and river, discharging into Clearwater river, northeastern Alberta. (Not Pembina.) To avoid duplication of the name Pembina applied to a larger stream tributary to Athabaska river.

Christopherson; lake, north of Grand lake Victoria, Timiskaming county, Que.

Christy; creek, east of Whatshan lake, Kootenay district, B.C.

Chrysler. See Crysler.

Chuan. See Saltspring.

Chuch Koone. See Chukuni.

Chudleigh. See Chidley.

Chudliasi; bay, north shore of Hudson strait, N.W.T. (Not Chudli-a-si.)

Chukuni; river, north of Red lake, Patricia district, Ont. (Not Chuch Koone nor Whitefish Spawning.)

Chungo; creek, tributary to south branch of Brazeau river, Alberta. (Not Trail.)

Church; point, Markham bay, Hudson strait, N.W.T.

Church; point, east of Becher bay, southern coast of Vancouver island, B.C.

Churchill; river, emptying into Hudson bay, Manitoba and Sask. (Not English or Missinnipi.)

Chute; cove, Annapolis county, N.S. (Not Chute's cove.)

Ciboux; island, at entrance to Great Bras d'Or, Victoria county, N.S. (Not Bird nor Hiboux.)

Cigar; island, north of Chiefs point, Bruce county, Ont.

Cinder; point, eastern side of Cockburn island, Manitoulin district, Ont.

Cinnamon; creek, west of Lower Arrow lake, Kootenay district, B.C.

Circle; lake, west of Favel lake, Kenora district, Ont.

Cirque; peak, northeast of Bow lake, Rocky mountains, Alberta.

Citadel; mountain, Sir Sandford range, Selkirk mountains, Kootenay district, B.C.

Citron. See Gordon.

Citrouille; point, St. Lawrence river, Champlain county, Que.

Clachnacudainn; range of mountains and snowfield, Selkirk mountains, Kootenay district, B.C. (Not Clach-na-coodin.)

Clairvaux-de-Bagot; post village, Bagot county, Que. (Not Clairvaux de Bagot.)

Clairville. See Humber.

Clapham; lake, Thetford township, Megantic county, Que.

Clappison; settlement. Wentworth county, Ont. (Not Clappison's Corners.)

Clark Fork. See Pend d'Oreille.

Clark; harbour, Cornell Grinnell bay, N.W.T. (Not Frank Clark.)

Clark; lake, Dungannon township, Hastings county, Ont. (Not Clark's.)

Clark; point, Gabarus bay, Cape Breton county, N.S. (Not Low.) New name to avoid confusion with Low point and Low Point P.O., George bay, Inverness Co.

Clark; point and reef, Bruce county, Ont. (Not Pine Point nor Clark Point reef.)

Clarke; glacier and peak, S.E. of Mt. Bonney, Selkirk Mts., Kootenay district, B.C

Clarke; island, Blind bay, Halifax county, N.S. (Not Clarke's.)

Claude; lake, near northerly end of lake Manitoba, Man.

Clay; brook and lake, Villeneuve township, Ottawa Co., Que. (Not Clay Brook lake.)

Clay; river, tributary to Bell river, Timiskaming county, Que.

Clayoquot; sound, also post village on Stubbs island in the sound, west coast of Vancouver island, B.C.

Clayoquot. See Opitsat.

Clear; creek, tributary to Stewart river, Yukon.

Clear. See Sasaginaga.

Clear. See Smooth Rock.

Clear. See Wakomata.

Clear Water. See Madge.

Clear Water. See Reader.

Clearwater; river, tributary to Athabaska river at McMurray, Alta. and Sask.

Clearwater; river, tributary to the Saskatchewan, at Rocky Mountain House, Alta.

Clearwater; river, tributary to Stikine river, Cassiar district, B.C.

Clearwater. See Teggau.

Cleaveland; point, S. shore of St. Margaret bay, Halifax Co. N.S. (Not Cleveland.)

Cleftrock; lake, west of Manitou lake, Kenora district, Ont. (Not Cleft Rock.)

Clements Land; in the southeastern portion of Baffin island, N.W.T.

Cleopatra; island; southwest of Grenadier I., St. Lawrence river, Leeds county, Ont.

Cleveland. See Cleaveland.

Cliff; lake, southwest of Perrault lake, Kenora district, Ont. (Not Mountain.)

Cline; mount, southwest of Sentinel mountain, also river flowing into the Saskatchewan, N. of Sentinel mountain, central Alberta. (Not White Goat nor Cataract.)

Clinton; creek, near Cudahy, Yukon.

Clinton-Colden; lake, northeast of Great Slave lake, N.W.T. (Not Clinton Golden.)

Clio; bay and point, Kitimat arm, Coast district, B.C.

Clondyke. See Klondike.

Cloridon. See Cloridorme.

Cloridorme; township and village, Gaspe county, Que. (Not Cloridon, Chlorydorme, nor Chlorydormes.)

Cloyah. See Kloiya.

Club; island, southwest of Rockport, St. Lawrence river, Leeds county, Ont.

Cluster; rocks, Ladysmith harbour, east coast of Vancouver island, B.C.

Clyde Corners; post office, Huntingdon county, Que. (Not Clyde's Corners.)

Coac. See Koak.

Coachman; head, east side of Mahone bay, Lunenburg county, N.S. (Not Covey.)

Coal; creek, tributary to Elk river, at Fernie, Kootenay district, B.C.

Coal; creek, tributary to Yukon river, below Fortymile, Yukon.

Coal; creek, lake, and ridge, north of Watson river, Yukon.

Coal. See Kirby.

Coast. island, west of Ridley island, Coast district, B.C.

Coast; range of mountains, in western part of British Columbia. (Not Cascade.)

Cobalt; lake and town, Timiskaming district, Ont.

Coban; river, tributary to Waswanipi R., below Otchisk R., Abitibi, Que. (Not Cabane.)

Cobb; lake, Russell county, Ont. (Not The lake.)

Cobble Hill; post office and railway station, west of Saanich inlet, Vancouver I., B.C.

Cocagne; harbour, island, river, and town, Kent county, N.B. (Not Cocaigne.)

Cochrane; river, flowing into Deer lake, south of Island lake, Patricia district, Ont.

Cock. See South Fowl.

Cockburn; island, Manitoulin district, Ont.

Cockburn; island, Brock group, St. Lawrence river, Leeds county, Ont. (Not Picnic.)

Cockburn; land, in N.W. portion of Baffin island, N.W.T. (Not Cockburn island.)

Cockmagun. See Cogmagun.

Cockmigon. See Cogmagun.

Cockscomb; mountain, near the headwaters of Jumpingpound creek, southern Alberta.

Coehill; P.O. and Ry. sta., Hastings county, Ont. (Not Coe Hill nor Coe Hill Mines.)

Coffee; river, tributary to Bell river, Timiskaming county, Que. (Not Brownwater.)

Coffey; post office, Huntingdon county, Que. (Not Coffey's Corners.)

Coffey's Corners. See Coffey.

Cogle; pass, at head of St. Mary river, Kootenay district, B.C.

Cogmagun; river, Hants county, N.S. (Not Cockmagun, nor Cockmigon.)

Colborne. See Colburne.

Colbourne. See Colburne.

Colburne; passage between Piers island and Saanich peninsula, southeast coast of Vancouver island, B.C. (Not Colborne nor Colbourne.)

Cold; brook, tributary to Gizzard river, Abitibi territory, Que.

Cold; lake, north of Beaver river, central Alberta and Saskatchewan.

Cold. See Kississing.

Coldbrook; post office and railway station, Kings county, N.S. (Not Cold Brook Station, P.O.)

Cold Brook. See Colebrooke.

Coldstream. river, flowing into L. St. Francis, Frontenac and Megantic counties, Q.

Coldwater; river, emptying into east end of L. Superior, Algoma, Ont. (Not Blind.)

Coldwater. See Bow.

Cole; point, northwest point of Big island, bay of Quinte, Prince Edward county, Ont. (Not Cole's.)

Cole; rapids, Saskatchewan river, above the entrance of the south branch, Sask. (Not Cole's nor La Colle.)

Colebrooke; settlement, south of Campbellton, Restigouche county, N.B. (Not Coldbrook, nor Cold Brook.)

Coleman; cove and harbour, west of entrance to St. Margaret bay, Lunenburg county, N.S. (Not Coleman's.)

Coleman; island, Sagemace bay, lake Winnipegosis, Manitoba.

Coleman; mount, southeast of mount Athabaska, Rocky mountains, Alberta.

Coleraine; railway station, township, and village, Megantic county, Que. (Not Colraine nor Coleraine Station post office.)

Collie; mount, northwest of mount Balfour, Rocky mountains, Kootenay district, B.C.

Collie. See Yoho.

Collier; island, Navy group, St. Lawrence river, Leeds county, Ont. (Not Collyer.)

Collins; shoal, Ladysmith harbour, east coast of Vancouver island, B.C.

Collinson; point, Active pass, strait of Georgia, New Westminster district, B.C.

Colmer; cape, at entrance to Crooks inlet, Hudson strait, N.W.T.

Colraine. See Coleraine.

Colombe. See Coulombe.

Colquhoun; island, in St. Lawrence river, below Cornwall, Glengarry county, Ont. (Not Colquhon nor Colquhouns.)

Columbia; lake, at source of Columbia river, Kootenay district, B.C. (Not Upper Columbia.)

Columbia; mount, also glacier and snowfield, west of Mt. Bryce, summit range of the Rockies, Alta., and Kootenay district, B.C.

Columbia; river, Kootenay district, B.C.

Comb; islands and river, east side of Hudson bay, New Quebec. (Not Comb Hills island and river.)

Commandant. See Papineau.

Commerell; point, south side of Raft cove, northwest coast of Vancouver island, B.C.

Commerell. See Sutil.

Commissioners; lake, Lake St. John county, Que. (Not Commissioner.)

Compass; lake, Burleigh township, Peterborough county, Ont.

Comporté; river, tributary to Murray river, Charlevoix county, Que.

Cone; hill, near mouth of Clinton creek, Yukon.

Cone; mountain, near Stikine river, north of Scud river, Cassiar district, B.C.

Cone; mountain, north of Spray mountains, Rocky Mountains park, Alberta.

Cone; point, on the west side of lake Evans, Abitibi territory, Que.

Connaught; mount, in the big bend of Salmon river, Kamloops district, B.C.

Conn Mills; village, Cumberland county, N.S. (Not Conn's Mills.)

Connolly; mount, between Mackenzie sound and Sutlej channel, Coast district, B.C. (Not Conolly.)

Conrad; mining camp, west shore Windy arm, Tagish L., Yukon. (Not Conrad City.)

Conrad; mount, east of Windy arm of Tagish lake, Cassiar district, B.C. and Yukon.

Conran; island, Brock group, St. Lawrence river, Leeds county, Ont. (Not Refugee.)

Consecon; lake and village, east of Weller bay, Prince Edward county, Ont.

Consolation, creek, emptying into Gladys lake, Cassiar district, B.C.

Consolation; valley, east of Moraine lake, Alberta.

Conspicuous peak. See Empress mountain.

Constance; island, between Georgina and Hill islands, St. Lawrence river, Leeds county, Ont. (Not Bowes.)

Contact; brook and lake, southeast of File lake, Manitoba.

Conuma; peak, northeast of Nookta sound, Vancouver island, B.C.

Cony; creek, near mount Woden, Kootenay district, B.C.

Cook; island, northeast of Grenadier island, St. Lawrence river, Leeds county, Ont.

Cook; lake, Britton township, Kenora district, Ont.

Cook; point below Rockport, Leeds county, Ont. (Not Cary nor Cook's.)

Cook; railway station, Haldimand county, Ont. (Not Cook's.)

Cooking; lake, in Tps. 51 and 52, R. 21, and Tp. 51, R. 22, W. 4th M., Alberta.

Coolen. See Coonan.

Coonan; cove, Shag bay, Halifax county, N.S. (Not Coolen.)

Cooper; lake, an expansion of Marten river, Mistassini territory, Que.

Cooper; mount, near Hutshi lakes, Yukon.

Cooper; point, south shore of Okisollo channel, Coast district, B.C.

Copeau; river, tributary to Red Deer river, eastern Saskatchewan.

Copeland; mount, Gold range, northwest of Revelstoke, Kootenay district, B.C.

Copeway; lake, Lake township, Hastings county, Ont.

Copper; creek, tributary to Hackett river, Cassiar district, B.C.

Copper; island, in southern portion of Atlin lake, Cassiar district, B.C.

Copper. See Zymoetz.

Coquihalla; lakes, mountain, and river, Yale district, B.C. (Not Coquahalla.)

Coral; mountain, Beaverfoot range, Yoho park, Rocky Mts., Kootenay district, B.C.

Corbay. See Corbeil.

Corbeil; point, northern entrance to Batchawana bay, Herrick township, Algoma, district, Ont. (Not Corbay.)

Corbin; pass and peak, north of Illecillewaet, Kootenay district, B.C.

Cordero; channel, N. of Sonora and Thurlow Is., Coast district, B.C. (Not Cardero.)
Josef Cordero was the draughtsman of Galiano's expedition in the "Sutil" and "Mexicana," 1792. Walbran's Coast names, B.C.

Cordova; bay, southeast coast of Vancouver island, B.C. (Not Cormorant.)

Cordova. See Saanichton.

Corisande; bay, east shore of lake Huron, Bruce county, Ont

Cormorant; lake, northwest of Moose lake, Manitoba.

Cormorant. See Cordova.

Corn; island, southeast of Gananoque, St. Lawrence river, Leeds county, Ont.

Corn; lake, Redditt township, Kenora district, Ont.

Corn. See Broughton.

Corneille; point, below Goose cape, St. Lawrence river, Charlevoix county, Que.

Cornet; ground, southwest of Greenough point, Bruce county, Ont.

Cornice; peak, southerly spur of mount Palmer, also glacier, Selkirk mountains, Kootenay district, B.C.

Corn island shoals. See Broughton.

Cornwall; island, north of Grinnell peninsula, N.W.T. (Not North Cornwall.)

Cornwallis; island, west of Devon island, N.W.T.

Cornwall Park; a summer resort on east extremity of Big island, bay of Quinte, Prince Edward county, Ont.

Coronation; mountain, north of Chemainus river, Vancouver island, B.C.

Corral; creek, tributary to Bow river, east of Laggan, Alberta.

Corry; lake, an expansion of Chalk river, Renfrew county, Ont. (Not Corry's nor Curry's.)

Corsair; mountain, N.E. of Blackwater range of the Rockies, Kootenay district, B.C.

Corsair; reef, west of Reid point, Bruce county, Ont.

Corwin; valley, north of Bennett lake, southern Yukon.

Cosine; lake, southeast of Eyehill creek, Sask.

Coste; island, Kitimat arm, Coast district, B.C.

Costigan; mount, northeast of Minnewanka lake, Rocky Mountains park, Alberta.

Coteau; lake, Tp. 27, R. 8, W. 3 M., also creek flowing from the lake into the south branch of Saskatchewan river, Sask. (Not Red Deer.)

Côte-des-Neiges-Ouest; village, Hochelaga county, Que. (Not Côte des Neiges West.)

Cottle; hill, northwest of Departure bay, Vancouver island, B.C. (Not Cattle.)

Cottonwood; creek, tributary to Waskana creek, southeastern Saskatchewan.

Cottonwood; river, tributary to Dease river, Cassiar district, B.C.

Couchiching; lake, north of lake Simcoe, Ontario and Simcoe counties, Ont.

Coudres; island, Charlevoix county, Que. French usage, Ile aux Coudres.

Cougar; brook and mountain, in the Selkirk mountains, Kootenay district, B.C.

Cougar; creek, tributary to Little Slocan river, Kootenay district, B.C.

Couldrey; creek, flowing easterly into Flathead river, near international boundary, Kootenay district, B.C. (Not Calder.)

Coulombe; lake and river, emptying into L. Aylmer, Wolfe Co., Que. (Not Colombe.)

Countess Warwick; sound, north shore Frobisher bay, N.W.T.

Country; island, with lightstation thereon, southeast of Goose island and of the entrance to Country harbour, Guysborough county, N.S. (Not Green.) To avoid duplication of "Green island lightstation," Richmond county.

Counts; bank, southwest of Dead island, at entrance to Key harbour, Georgian bay, Parry Sound district, Ont.

Courcelles; parish and post office, Frontenac county, Que.

Courteney; bay, St. John harbour, N.B. (Not Courtney.)

Coutlee; plateau, railway station, and town, Kamloops district, B.C. (Not Coutlie.)

Coutts; river, tributary to Saulteux river, central Alberta.

Cove; island, in entrance to Georgian bay, Bruce county, Ont. (Not Isle of Coves.)

Cove Island; ground, off N.W. side of Cove island, Georgian bay, Bruce county, Ont.

Covey. See Coachman.

Cow; island, in bay of Quinte, east of Belleville, Prince Edward county, Ont.

Cow. See Morien.

Cowan; lake and river, tributary to Beaver river, central Sask. (Not Crooked.)

Cowan; post office, Huntingdon county, Que. (Not Cowan's.)

Cowan; river, north of Cormorant lake, Manitoba.

Cow Bay (village). See Port Morien.

Cowichan; district, harbour, lake, post office, and river, Vancouver island, B.C. (Not Cowichin nor Cowitchin.)

Cowichan. See Separation.

Cowitchin. See Cowichan.

Cox; lake, Burleigh township, Peterborough county, Ont. (Not Cox's.)

Coyle; cove and head, W. side Blind bay, Halifax Co., N.S. (Not Coyle's nor Kieley.)

Crab; cove, south of Red bay, Bruce county, Ont.

Craigs. See Stanley.

Cranberry; creek, near north end of Upper Arrow lake, Kootenay district, BC.

Cranberry; lake, on Grass river, west of Reed lake, Manitoba.

Cranbrook; town, Kootenay district, B.C.

Crane; bay, lake, and river, at northerly end of lake Manitoba, Man.

Crater; creek, flowing into Quiet lake, Yukon.

Crater; lake, southwest of lake Lindeman, Cassiar district, B.C.

Crayfish; lake, on Grassberry river, central Saskatchewan. (Not Lobster.)

Crean; creek and lake, tributary to Montreal lake, central Sask. (Not Trout.)

Crease; island, off the entrance to Knight inlet, Coast district, B.C. (Not Lewis.)

Credit Forks; post village and railway station, Peel county, Ont. (Not Forks of Credit.)

Creighton. See Crichton.

Crémazie; lake, Sabourin township, Timiskaming county, Que. (Not Sturgeon.)

Crete. See Chamberlain.

Crichton; beach, head, island, and shoal, southwest of Madame island, Richmond county, N.S. (Not Creighton.)

Croil; island, near Farran point, Stormont county, Ont. (Not Croil's.)

Crooked; creek, tributary to Stewart river, Yukon.

Crooked; lake, international boundary, Rainy River district, Ont.

Crooked; lake, on Qu'Appelle river, southeastern Saskatchewan.

Crooked. See Caron.

Crooked. See Cowan.

Crooked. See Wakaw.

Crooks; inlet, north shore of Hudson strait, N.W.T. (Not Ka-lik-took-duag.)

Crosby; lake, in McVittie township Timiskaming district, Ont.

Cross; lake, north of Pipestone lake, Nelson river, Manitoba.

Cross; point, also Cross Point, post village and railway station, Mann township, Bonaventure county, Que. (Not Crosspoint P.O.)

For the point the French form is authorized for French maps.

Cross. See Bamaji.

Cross. See Brion.

Cross. See Paquin.

Crossman. post office, Albert county, N.B. (Not Niagara.)

Crow; river, Hastings and Peterborough counties, Ont.

Crow. See Kakagi.

Crowfoot; creek, flowing into Bow river, southwest of Crowfoot station, southern Alberta.

Crow Harbour. See Queensport.

Crowlodge; creek, tributary to Oldman river, southern Alberta.

Crown; lake, Lorrain township, Timiskaming district, Ont.

Crown; mountain, in central part of Vancouver island, B.C.

Crowsnest; lake, mountain, pass, railway station, and river, Alberta, and Kootenay district, B.C. (Not Crow Nest, Crow's Nest, Crow-nest, nor Crownest.)

Crysler; post village and railway station, Stormont county, Ont. (Not Chrysler.)

Crysler; island, St. Lawrence river, Dundas county, Ont. (Not Chrysler.)

Crystal; bay, southwest of Thunder bay, L. Superior, Ont.

Crystal; butte, creek, and mountain, east of Beaverdell creek, Similkameen district, B.C. (Not S. fork of Beaver creek.)

Crystal. See Caldwell.

Cudahy; post, Yukon river, northwest of Dawson, Yukon.

Cultus; lake, near international boundary, New Westminster district, B.C. (Not Swehl-tcha.)

Cumberland; lake, eastern Saskatchewan. (Not Pine Island lake.)

Cumberland; peninsula and sound, in southeastern portion of Baffin island, N.W.T. (Not Northumberland inlet, Hogarth sound, nor Penny gulf.)

Cumming; point, Drury inlet, Queen Charlotte sound, Coast district, B.C. (Not Cuming nor Cummings.)

Cumming; point, Gribbell island, Coast district, B.C.

Cundale; bay, east shore of Horsfall island, Hecate channel, Coast district, B.C.

Cunliffe; island, Navy group, St. Lawrence river, Leeds county, Ont. (Not Gunliffe.)

Cupola; mountain, Selkirk range, Kootenay district, B.C.

Currie; mount, west of Lillooet lake, Lillooet district, B.C.

Currie; post village and railway station, Oxford Co., Ont. (Not Currie's Crossing.)

Currie's Crossing. See Currie.

Curry's. See Corry.

Curtain; falls, between Crooked and Iron lakes, Int. boundary, Rainy River dist., Ont.

Curtis; peak, southeast of Mt. Biddle, Rocky mountains, Kootenay district, B.C.

Cut. See Lindsay.

Cutarm; river, tributary to Qu'Appelle river, southern Sask. (Not Big Cutarm.)

Cutknife; creek, hill, and post office, S. of Battle river, Sask. (Not Cut Knife.)

Cyclone; peak, an outlying spur of mount Drummond, Rocky mountains, Alberta.

Cypress; hills, southern Alberta and Saskatchewan.

Cypress; lake, south of Cypress hills, southwestern Saskatchewan.

Cypress; lake, southwest of Saganaga lake, Int. boundary, Rainy River district, Ont.

Cypress; river, tributary to Assiniboine river, southern Manitoba.

Cyprian; peak, in the Bishops' range, Selkirk mountains, Kootenay district, B.C.

Cyrus Field; bay, east shore of Baffin island, N.W.T. (Not Cyrus W. Field.)

D

Dack; spit, west of Port Elgin, Bruce county, Ont.

Dadancour. See Giroux.

Dago; creek, tributary to Little Slocan river, Kootenay district, B.C.

Dahadinni; river, trib. to Mackenzie R., N.W.T. (Not Dahadinee nor Dahadinne.)

Dail; creek and peak, west of Windy arm, Tagish lake, Yukon.

Dainard; creek, tributary to Moose creek, also lake east of the creek, Yoho park, Rocky mountains, Kootenay district, B.C.

Daisy; lake, emptying into Cheakamus river, New Westminster district, B.C.

Dalesville; river, tributary to West river, Argenteuil county, Que. (Not Middle Branch of West River.)

Dalhousie Mills. See Dalhousie Station.

Dalhousie Station; post village, Soulanges county, Que. (Not Dalhousie Mills.)

D'Alogmy. See Maple.

Dalton; range of mountains, near Dezadeash lake, southwest Yukon.

Daly; mount, southeast of mount Balfour, Rocky mountains, Kootenay district, B.C.

Dane; island, east of Lyal island, Bruce county, Ont.

Daniels; lake, north of Linklater lake, Kenora district, Ont. (Not Daniel nor Danish.)

Danish. See Daniels.

Daoust; mount, south of Lewes river, Yukon.

Dares; point, east side of Mahone bay, Lunenburg county, N.S. (Not Indian.)

Dark; island, Admiralty group, St. Lawrence river, Leeds county, Ont.

Dark. See Aubrey.

Darlens; river, Darlens township, Timiskaming county, Que. (Not Bear.)

Darlington; post office, railway station, and township, Durham county, Ont.

Dashwood; island, east of Wallace island, St. Lawrence river, Leeds county, Ont.

Dasserat; lake, Timiskaming county, Que. (Not Island, Mattawagosik, nor Obadowagashing.) Previous decision revised.

Dauphin; lake and town, western Manitoba.

Dauphin; river, emptying into Sturgeon bay, lake Winnipeg, Man. (Not Little Saskatchewan.)

Dauphinee; head, Hubbard cove, mountain north of Head harbour, Halifax county, and lake northeast of St. Margaret bay, Halifax and Lunenburg counties, N.S. (Not Dauphiney nor Dauphney.)

Dauphney. See Dauphinee.

Dave; bay, south side of Great Duck island, Manitoulin district, Ont.

Davenport; creek, flowing into west end of Gladys lake, Cassiar district, B.C.

David; point, Shawatlan passage, northeast of Kaien island, Coast district, B.C.

Davidson; mountains, betweeen Ladue river valley and McQuesten lakes, Yukon.

Davies; lake, west of Barnard lake, Thunder Bay district, Ont.

Davis; creek, branch of Walker creek, west of Dawson, Yukon.

Davis; island, Navy group, St. Lawrence river, Leeds county, Ont.

Davis; lake, Lutterworth township, Haliburton county, Ont. (Not Davis'.)

Davy; lake and river, Trécesson township, Timiskaming county, Que. (Not Davie.)

Dawkins. See Jorkins.

Dawson; bay, in northwestern portion of L. Winnipegosis, Manitoba.

Dawson; capital city of Yukon territory. (Not Dawson City.)

Dawson; island, lake Nipigon, Thunder Bay district, Ont.

Dawson; mount, also glacier, southeast of mount Bonney, Selkirk mountains, Kootenay district, B.C.

Dawson; peak, near Teslin lake, Yukon.

Dawson; point, at the northerly end of Primrose island, Coast district, B.C.

Dawson; point, at the head of lake Timiskaming, Ont.

Dawson; range of mts., at confluence of Lewes, Pelly, and Yukon rivers, Yukon.

Dawsonvale. See Dawsonville.

Dawsonville; town, Restigouche county, N.B. (Not Dawsonvale.)

Dayman; island, west of Kuper island, S.E. coast of Vancouver island, B.C.

Deacon; lake, Melick, Pettypiece, and Redditt Tps., Kenora district, Ont. (Not Ant.)

Dead; island, also Dead Island reef, at entrance to Key harbour, Georgian bay, Parry Sound district, Ont.

Deadman; harbour and head, Charlotte county, N.B. (Not Deadman's.)

Deadman; islets (2), east of Beck island, also the navigable channel between the islets and the spit extending north from Felice (Round) island, Clayoquot sound, Vancouver island, B.C.

Deadwood; creek, tributary to Yukon river, below Dawson, Yukon.

Dean; bay and spit, east of Dominion point, Manitoulin district, Ont.

Dease; lake and river, tributary to Liard river, Cassiar district, B.C.

Deathdealer; island, Lake Fleet group, St. Lawrence river, Leeds county, Ont.

DeBeaujeu; island, St. Lawrence river, Soulanges county, Que. Not Grande île aux Erables.)

Debert; river and village, Colchester county, N.S. (Not DeBert.)

Debert. See Masstown.

Deception; bay, south shore Hudson strait, New Quebec. (Not Foster's Harbour nor Shedlui.)

DeCewville; post village and Ry. station, Haldimand Co., Ont. (Not Decewsville.)

Decker; lake, on telegraph trail, south of Babine lake, Coast district, B.C.

DeCourcy; group of islands, Pylades channel, southeastern coast of Vancouver island, B.C. (Not DeCourcey.)

Deep. See Canyon.

Deep creek. See Trepanege river.

Deepwater; lake, northeast of lake Timiskaming, Timiskaming county, Que.

Deer; island, 1½ m. N. W. from Gull harbour, L. Winnipeg, Man. (Not Punk.)

Deer. See Atikwa.

Deer. See Georgina.

Deer. See Punk.

Deer Park; mountain, post office, and landing to important mining district, east of Lower Arrow lake, Kootenay district, B.C. (Not Deer mountain.)

Defot; mount, also creek, Dease river, Cassiar district, B.C.

Delany; lake, southeast of Lount lake, Kenora district, Ont.

Delap Cove; village, Annapolis county, N.S. (Not Delap's Cove.)

Delisle; river, Glengarry county, Ont. (Not De Lisle nor L'Isle.)

Deltaform; mountain, Bow range of the Rockies, Alta. and Kootenay district, B.C.

Delthore; mount, Gravel river, N.W.T.

Delusion; bay, in southern portion of Digby island, Coast district, B.C.

Demaniel; creek, flowing into Sooke harbour, Vancouver island, B.C.

Demers; a peak of the Valhalla mountains, Kootenay district, B.C. (Not DeMers.)

Demers; rock, east of Brandypot channel, St. Lawrence river, Temiscouta Co., Que.

Demoiselle; cape and creek, Albert county, N.B. (Not D'Moiselle, Cap de Moselle, nor Cape de Moiselle.)

De Montigny; lake, Dubuisson and Varsan townships, Timiskaming county, Que. (Not Kienawisik.)

Denise; arm, northeast arm of Morse basin, east of Kaien island, Coast district, B.C.

Denmark; lake, south of Atikwa lake, Kenora district, Ont.

Dennis; mount, also pass, south of mount Stephen, Kootenay district, B.C.

Dennis. See Denys.

Dent; mount, north of Blaeberry river, Rocky mountains, Kootenay district, B.C.

Denver; creek, tributary to St. Mary river, Kootenay district, B.C.

Denver; mount, west of Slocan lake, Kootenay district, B.C.

Denys; river, Inverness county, N.S.; also River Denys P.O., River Denys Road P.O. River Denys Station, P.O. (Not Dennis.)

Departure; bay, north of Nanaimo, Vancouver island, B.C.

Depot; island, west of Supply point, Depot harbour, Parry Sound district, Ont. (Not Supply.)

DeRottenburg; island, Brock group, St. Lawrence, R., Leeds Co., Ont. (Not Bluff.)

Derry; post office, Peel county, Ont. (Not Derry West.)

Derry West. See Derry.

DeSalaberry; island, St. Lawrence river, Beauharnois county, Que. (Not Grand.)

Descanso; bay, Gabriola island, strait of Georgia, B.C. (Not Knight nor Rocky.)

Deschaillons; seigniory and post village, Lotbinière county, and island in Richelieu river, Richelieu county, Que. (Not d'Eschaillons, des Chaillons, Eschaillons, St. Jean Deschaillons, nor St. Jean-Baptiste Deschaillons.)

Deschambault; lake, and river flowing from Wapawekka lake, central Saskatchewan. (Not Bear Lake river.)

Deschênes; post office, Ottawa county, Que. (Not Deschenes Mills.)

Deschesnes Mills. See Deschênes.

D'Escousse; harbour, port of entry, and post village, Madame island, Richmond county, N.S. (Not Descouse, Descousse, nor Discousse.)

Deseronto; town, Tyendinaga township, Hastings county, Ont.

Desert; point, N.E. end of Great Duck island, Manitoulin district, Ont. (Not Sand.)

Deseticaux See Azatika.

Despair. See Espoir.

Despatch. See Dispatch.

Desolation. See Ten Peaks.

Desolation. See Wenkchemna.

DeStein; point, west of Russell arm, Prince Rupert harbour, Coast district, B.C.

Deville; mount, northwest of Ottertail station, Rocky Mts., Kootenay district, B.C.

Devils Head; mountain, in the Rocky Mountains park, Alberta. (Not Devil's Head.)

Devil's Head (lake). See Minnewanka.

Devil's Pine. See Ghostpine.

Devizes; lake, west of Barrington lake, Thunder Bay district, Ont.

Devon; island, northwest of Baffin island, N.W.T. (Not North Devon.)

DeWatteville; island, southeast of the Brock group, St. Lawrence river, Leeds county, Ont. (Not Guide.)

Dewdney; mount, Porcupine river, Yukon.

Dezadeash; lake, and river tributary to the Alsek, southwestern Yukon.

Dez Amecane. See Azatika.

Diable (cap au); cape, western entrance Kamouraska bay, Kamouraska Co., Que.

Diamond; island, west of Jubilee island, north shore of Hudson strait, N.W.T.

Diamond; lake, Herschel township, Hastings county, Ont.

Diana; bay, west of Cape Hopes Advance, Hudson strait, New Quebec.

Dibble; creek, tributary to Bull river, Kootenay district, B.C.

Dickey; lake, Lake township, Hastings county, Ont. (Not Dickey's.)

Dickinson Landing; post village, Stormont county, Ont. Not Dickenson's Landing nor Dickinson's Landing.)

Dickson; hill, south of Wheaton river, southern Yukon.

Dinghy; island, between Barge and Deathdealer islands, Lake Fleet group, St. Lawrence river, Leeds county, Ont. (Not 34g.)

Dinorwic; lake and railway station, Kenora district, Ont. (Not Little Wabigoon.)

Dion; creek, tributary to Yukon river, near Dawson, Yukon.

Dirt. See Chip.

Dirtywater. See Houghton.

Discousse. See D'Escousse.

Discovery; lake, east of Minnitaki lake, Kenora district, Ont.

Discovery. See Plumber.

Disella; lake, south of Chismaina lake, Yukon.

Dispatch; island, in Columbia river, near south end of Upper Arrow lake, Kootenay district, B.C. (Not Despatch.)

Division; mountain, east of Schwatka river, southern Yukon.

Dixie; mount, also lake, east of Atlin lake, Cassiar district, B.C.

Dixie. See O'Donnel.

Dixon; lake, Limerick township, Hastings county, Ont. (Not Dixon's.)

Dixon Corners; post village, Dundas county, Ont. (Not Dixon's Corners.)

Dobbs; island, N. of Gordon island, St. Lawrence R., Leeds county, Ont. (Not Hay.)

Doctor; island, S.E. of Tar island, St. Lawrence R., Leeds Co., Ont. (Not Doctor's.)

Doctor, island, south shore of Hudson strait, New Quebec.

Doctor; island, between Russell island and Tobermory harbour, at entrance to Georgian bay, Bruce county, Ont.

Doctor; lake, on Churchill river, Sask.

Dodd; narrows, between Mudge and Vancouver islands, B.C.

Dodge; cove, W. of Parizeau Pt., Digby I., Prince Rupert harbour, Coast district, B.C.

Dodge; island, north of Parizeau point, Prince Rupert harbour, Coast district, B.C.

Dog; island, also Dog Island lightstation, opposite Seal cove, north shore of Lennox passage, Richmond county, N.S. (Not Seal.)

Doghead; point, the northeastern point of entrance to the narrows of lake Winnipeg, Man. (Not East Doghead.)

Dognose; creek, tributary to Klondike river, Yukon.

Dog's Head. See Whiteway.

Dogtooth; mountains, Selkirk range, Kootenay district, B.C.

Dokdaon; creek, tributary to Stikine R., near Clearwater R., Cassiar district, B.C.

Dokis; island, at entrance to Key harbour, Georgian bay, Parry Sound district, Ont.

Dollis; creek, tributary to Tatshenshini river, southwestern Yukon.

Dolomite; lake, south of Reed lake, Manitoba. (Not Limestone.)

Dolomite; pass, peak, and stream, Rocky mountains, Alberta.

Dombourg; islet, in St. Lawrence river, near Pointe-aux-Trembles, Portneuf county, Que. (Not Donbour nor Frechette.)

Dome; mountain, west of Cudahy, near international boundary, Yukon.

Dome; mountain, near lake Evans, Abitibi territory, Que.

Dominick; lake, Rugby township, Kenora district, Ont. (Not Dominic.)

Dominion; bay and point, south shore of Manitoulin island, Manitoulin district, Ont.

Dominion; creek, tributary to Indian river, Yukon.

Don; lake, west of Favel lake, Kenora district, Ont.

Don; river, flowing into lake Ontario, York county, Ont. (Not West Branch of Don river.)

Don. See Little Don.

Donald. See McDonald.

Donaldson; island, east of Sooke inlet, Vancouver island, B.C. (Not Secretary.)

Donbour. See Dombourg.

Dondaine; islands, St. Lawrence river, near Valleyfield, Soulanges county, Que. (Not Soulanges.)

Donjek; river, tributary to White river, Yukon.

Donkin; mount, also glacier and pass, southeast of mount Bonney, Selkirk Mts., Kootenay district, B.C.

Doobaunt. See Dubawnt.

Dorcas; bay, east coast of lake Huron, Bruce county, Ont.

D'Or; cape, Cumberland county, N.S. (Not Dore nor D'Ore.)

Doré (baie du); bay, Bruce county, Ont.

Dore. See D'Or.

Dorion. See Vaudreuil.

Dorothy; island and narrows, Devastation channel, Coast district, B.C.

Dotty; lake, Finlayson township, Nipissing district, Ont. (Not Dotty's.)

Double. See Brandon.

Douglas; channel, between Hawkesbury island and the mainland, Coast district, B.C.

Douglas; creek, southwest of Banff, Alberta.

Douglas; harbour, King George sound, Hudson strait, New Quebec.

Douglas; lake, east of mount Douglas, Rocky mountains, Alberta.

Douglas; mount, at headwaters of Red Deer river, Rocky mountains, Alberta.

Douglas; mount, north of Victoria, B.C.

Douglas; point, Bruce county, Ont.

Douglas; point, E. entrance Melville arm, Prince Rupert harbour, Coast district, B.C.

Douglas. See Protection.

Dover. See Taylor.

Dover East; township, Kent county, Ont. (Not East Dover.)

Dover South. See Paincourt.

Dowker. See Lynch.

Dowling; lake, south of Sullivan lake, southern Alberta.

Downey; bay, Ottawa river, Sheen township, Pontiac county, Que. (Not Armstrong nor Downey's.)

Downie; island, Navy group, St. Lawrence river, Leeds county, Ont. (Not Float.)

Doyle; island, Blind bay, Halifax county, N.S. (Not Doyle's.)

Dozois; lake, east of Grand lake Victoria, Pontiac county, Que. (Not Birch.)

Drag; lake, Dudley township, Haliburton county, Ont.

Drewry; lake, Haycock township, Kenora district, Ont.

Driedmeat; hill and lake, on Battle river, eastern Alberta. (Not Dried Meat.)

Drifting; river, tributary to Valley river, western Manitoba.

Driftpile; river, flowing northerly into Lesser Slave lake, central Alberta.

Driftwood; creek, flowing westerly into Bulkley river, Coast district, B.C.

Dromedary; island, N.E. of Grenadier I., St. Lawrence R., Leeds Co., Ont. (Not Pear.)

Drumming; point, northeast extreme of Black island, lake Winnipeg, Man.

Drummond; mount, at headwaters of Red Deer river, Rocky Mountains park, Alta.

Drummondville Junction. See Sutton Junction.

Dryad; point, northeastern portion of Campbell island, Seaforth channel, Coast district, B.C. (Not Turn.)

Dryberry; lake, northeast of Berry lake, Kenora district, Ont.

Dryden; railway station, Kenora district, Ont.

Dubawnt; lake and river, N.W.T. (Not Doobaunt.)

Duchesnay; mount, also lake and pass, Rocky mountains, Kootenay district, B.C.

Duck; lake, southeast of Carlton, central Saskatchewan.

Duck; mountain, also Duck Mountain Forest reserve, western Manitoba.

Duck. See Sissipuk.

Duckie; lake, northwest of Chismaina lake, Yukon.

Duck Lake; Indian reserve, P.O. and railway station, southeast of Carlton, Sask.

Duck River North. See North Duck.

Duck River South. See South Duck.

Dudidontu; river, tributary to Inklin river, Cassiar district, B.C.

Dufault; lake, Dufresnoy township, Timiskaming Co., Que. (Not Lake of Islands.)

Dufay; lake, east of Hébert lake, Dufay township, Timiskaming, Que. (Not Rest.)

Duffin; creek, flowing into lake Ontario, Ontario county, Ont. (Not Duffins.)

Duffin; passage, between Felice island and Low peninsula, Clayoquot sound, Vancouver island, B.C.

Dufresnoy; lake, Destor and Dufresnoy townships, Timiskaming county, Que. (Not Kajakanikamak.) Previous decision revised.

Duke; point, Northumberland channel, strait of Georgia, New Westminster district, B.C.

Dumais; islet, northern of 3 rocky islets in the St. Lawrence, off St. Germain, Kamouraska county, Que.

Dumfounder; island, Lake Fleet group, St. Lawrence river, Leeds county, Ont.

Dumoine; lake and river, Timiskaming, Que. (Not Du Moine, Big, nor Grand.)

Duncan; mount, also glacier, east of Beaver Mt., Selkirk range, Kootenay, B.C.

Duncan; lake, north of Kootenay lake, Kootenay district, B.C. (Not Howser nor Upper Kootenay.)

Duncan; post office and railway station, Vancouver island, B.C. (Not Duncan's nor Duncan's Station.)

Duncan; river, flowing southeasterly into Duncan lake, Kootenay district, B.C.

Dundalk; mount, also creek and railway station, on east side of Bennett lake, Yukon.

Dundas; islands, western side of Chatham sound, Coast district, B.C.

Dundas; point, on northeast coast of Digby island, Coast district, B.C.

Dunn; island, near Pearson island, Manitoulin district, Ont. (Not Grant.)

Dunsekikan; island, lake St. Martin, Man.

Dunsmuir; islands, Ladysmith harbour, Vancouver island, B.C. (Not Twin.)

Dunvegan; a post of the H.B. Co., on Peace river, Alberta. (Not Fort Dunvegan.)

Duparquet; lake, Duparquet and Hébécourt townships, Timiskaming county, Que. (Not Agotawekami.) Previous decision revised.

Duplex; mountain, south of Lyell creek, Rocky mountains, Alberta.

Dutch; creek, flowing easterly into Oldman river, southern Alberta.

DuVernet; point, on northeast coast of Digby island, Coast district, B.C.

Dwyerhill; post office, Carleton county, Ont. (Not Dwyer Hill.)

Dyer. See Waddell.

Dyke; head, on south shore of Hudson strait, New Quebec.

Dyment; railway station, Kenora district, Ont.

Dyson; creek, tributary to Sheep river, also mountain, southern Alberta.

E

Eabemet; lake and river, tributary to Albany river, Patricia district, Ont.

Eagle; bay, at the south end of Grand lake Victoria, Timiskaming county, Que.

Eagle; cape, above St. Fidèle, Charlevoix county, Que.

Eagle; cove and point, Cove island, at entrance to Georgian Bay, Ont.

Eagle; glacier and peak, Selkirk mountains, also pass and river west of Revelstoke, Kootenay district, B.C.

Eagle; hills, southwest of Battleford, Sask.

Eagle; lake, railway station, and river, Kenora district, Ont.

Eagle; lake, southeast of Tatla lake, Coast district, B.C.

Eagle; river, tributary to Dease river, Cassiar district, B.C.

Eagle. See Aigles.

Eagle. See Anstruther.

Eagle. See Kiyiu.

Eagle. See Murphy.

Eagle. See Sakwatamau.

Eagle Crag; mountain, near confluence of Iskut and Stikine rivers, Cassiar, B.C.

Eaglehill; creek, flowing into the Saskatchewan, west of Elbow station, southern Sask. (Not Eagle nor Eagle Hill.)

Eaglenest; lake, in the Birch mountains, Alberta. (Not Eagle Nest.)

Eaglenest; P.O., Brant Co., Ont. (Not Eagle Nest, Eagles Nest, nor Eagle's Nest.)

Eagle Nest; mountain, on lower Lewes river, below Little Salmon river, Yukon.

Eagle Rock; lake, northeast of Kaopskikamak lake, Kenora district, Ont.

Eamer; village, Stormont county, Ont. (Not Eamer's Corners.)

Ear; lake, northwest of Tramping lake, Sask.

Earl Grey; pass, in the summit range of the Selkirks, between Hammill and Toby creeks, Kootenay district, B.C.

Earl Grey; river, emptying into L. Aylmer, N.E. of Great Slave L. (Not Earl Grey's.)

Earl Patches; shoals, S. of Russel I., entrance to Georgian bay, Bruce county, Ont.

Earn; river, tributary to Pelly river, north of Glenlyon mountains, Yukon.

East; bluff, west of Gabriel strait, N.W.T. (Not Innarulligang.)

East; lake, Harburn township, Haliburton county, Ont.

East; river, Bonaventure county, Que. (Not East Port Daniel river.)

East; river, Pictou county, N.S. (Not East river of Pictou.)

East. See Nelson.

East Arrowwood; river, tributary to Bow river, Alberta. (Not East Arrow Wood.)

East Belanger. See Girouard.

E. Br. Athabaska R. See Sunwapta.

E. Br. Thessalon R. See Bridgland.

East Caledon. See Caledon East.

East Chimney Island (shoals). See Griswold.

East Doghead. See Doghead.

East Dover. See Dover East.

East Flamboro. See Flamboro East.

E. Fork of W. Fork Kettle R. See Trapper creek.

Eastmain; river, emptying into James bay, Que. (Not East Main.)

Eastman's Springs. See Carlsbad Springs.

Easton; post village, Grenville county, Ont. (Not Easton's Corners.)

Easton's Corners. See Easton.

East Point. See Quebec head.

East Port Daniel river. See East.

East Sister; shoal, S. of Yeo I., entrance to Georgian bay, Manitoulin district, Ont.

East Souris. See Souris.

Eatchepashi. See Etchipotchi.

Eau Dorée; (rivière à l') river, tributary to Moisie river, Saguenay county, Que. (Not Takameshau.)

Ebb-and-Flow; lake, W. of the narrows of L. Manitoba, Man. (Not Ebb and Flow.)

Ecapo. See Ekapo.

Echafaud. See Pouce Coupé.

Echimamish; river, tributary to the east branch of Nelson river, Manitoba. (Not Echamamish nor Echiamamish.)

Echo; island, east of Cove island, at entrance to Georgian bay, Bruce county, Ont.

Echo; lake, an expansion of Qu'Appelle river above Lebret lake, Sask., in the chain of the "Fishing lakes," which see.

Ecstall; river, flowing into the Skeena at Essington, Coast district, B.C. (Not Hockstall, Huckstall, Huxstall, nor Oxstall.)

Ecstew. See Exstew.

Eddy; railway station, north shore of Skeena river, Coast district, B.C.

Eddy's Mills. See Edy Mills.

Edgar; lake, south of the Taku arm of Tagish lake, Cassiar district, B.C.

Edgar; settlement, Essex county, Ont. (Not Edgar's Mills.)

Edgar's Mills. See Edgar.

Edgell; banks, Nanoose harbour, east coast of Vancouver island, B.C.

Edgell; island in Blunden harbour, Queen Charlotte sound, Coast district, B.C.

Edgett; cape, near Edgett landing, Albert county, N.B. (Not Big.)

Edith; lake and river, Big island, Hudson strait, N.W.T.

Edith; mount, west of the north end of lake Laberge, Yukon.

Edith. See Bailey.

Edmonton; capital city of Alberta. (Not Fort Edmonton.)

Edmund; mount, northwest of Surprise lake, Cassiar district, B.C.

Edmund; rock, off Commerell point, northwest coast of Vancouver island, B.C.

Edna; point, forms eastern boundary of Christina bay, Manitoulin I., L. Huron, Ont.

Eduni; mountain, Gravel river, N.W.T.

Edward; island, and harbour in the southwest portion of the island, south of entrance to Black bay, Thunder Bay district, Ont.

Edward; lake, Smellie township, Kenora district, Ont.

Edward; point, at the entrance to St. Clair river, Lambton county, Ont.

Edy Mills; post office and railway station, Lambton county, Ont. (Not Eddy's, Eddy's Mills, nor Edy's Mills.)

Eel; lake, southwest of Opasatika lake, Timiskaming county, Que.

Eel. See Pontleroy.

Eels; lake, Cardiff township, Haliburton county, Ont. (Not Eel.)

Effingham; island, inlet, and port on the island, Barkley sound, B.C.

Effingham; lake, Effingham Tp., Addington Co., Ont. (Not Little Weslemcoon.)

Egan; brook and lake, tributary to York R., Hastings Co., Ont. (Not Jamieson's.)

Egg. See Scotch Bonnet.

Eglinton; post office, York county, Ont. (Not Eglington.)

Egnell; creek and mountain, Sheslay R., Cassiar, B.C. (Not Egnelle nor Egnell's.)

Ego; mountain, north of Lyell creek, Rocky mountains, Alberta.

Egypt. See Macdonald.

Ehkwee. See Ekwi.

Eider; islands, west coast Ungava bay, New Quebec.

Eiffel; peak, south of Pinnacle mountain, Rocky mountains, Alberta.

Eightmile. See Tatsho.

Eighteen-mile. See Stirling.

Eins; lake, east of Tramping lake, Saskatchewan.

Eisner; cove, Halifax har., Halifax Co., N.S. (Not Isnor, Eisenhaur, nor Eisenhauer.)

Ekapo; lake, east of Weed hills, southeastern Saskatchewan. (Not Ecapo.)

Ekwan; river emptying into James bay, Patricia district, Ont. (Not Equan.)

Ekwi; river, tributary to Gravel river, N.W.T. (Not Ehkwee.)

Elbow; lake, north of Stranger lake, Kenora district, Ont.

Elbow; lake, on Grass river, northwest of Reed lake, Manitoba. (Not Ithenotosquan nor The Elbow.)

Elbow; lake, northeast of Humboldt bay, L. Nipigon, Thunder Bay district, Ont.

Elbow; mountain, at bend in lower part of Stikine river, Cassiar district, B.C.

Elbow; river, tributary to Bow river, Alberta.

Elder Mills; post village and Ry. sta., York Co., Ont. (Not Elder nor Elder's Mills.)

Eldorado; creek, tributary to Bonanza creek, Yukon.

Eliot; passage, between Indian islands and Village island, at south entrance to Knight inlet, Coast district, B.C. (Not Elliot.)

Elizabeth; bay, in southern portion of Olga lake, Abitibi territory, Que.

Elizabeth; lake, on northwest corner of Purdom township, Thunder Bay district, Ont. (Not Sharp Mountain lake.)

Elizabeth; point, N. of Parizeau Pt., W. side Prince Rupert harbour, Coast dist., B.C.

Elk; mountains and river, southern Alberta, and Kootenay district, B.C.

Elk; river, tributary to Kootenay river, Kootenay district, B.C.

Elkwater; lake, Tp. 8, R. 3, W. 4th M., Alberta.

Ella; island, north of Leach island, Manitoulin district, Ont. (Not Gull.)

Ellesmere; island, includes the whole of the insular tract lying between latitude 76° and 84° N. and longitude 62° and 90° W.; portions of which have been named "Arthur Land," "Ellesmere Land," "Grant Land," "Grinnell Land," "Jesup Land," "King Oscar Land," "North Lincoln," Schley Land," etc.

Ellinor; rock, east of Kinahan islands, southwest of entrance to Prince Rupert harbour, Coast district, B.C.

Elliott; peak, on north side of the Saskatchewan, opposite the confluence of the Saskatchewan and Siffleur rivers, Alberta.

Elmtree; post village and river, Gloucester county, N.B. (Not Elm Tree.)

Embarras; river, tributary to McLeod river, central Alberta.

Embrun; railway station and village, Russell county, Ont.

Emerald; lake, peak, and river, northwest of Field, Kootenay district, B.C.

Emerald. See Louise.

Emerald. See President.

Emil; creek, tributary to Nello river, Klondike river, Yukon.

Emilia; island, Douglas channel, west of Maitland island, Coast district, B.C.

Emily Maxwell; reef, south of Fitzwilliam island, Manitoulin district, Ont.

Emma; island, northwest of Big island, Hudson strait, N.W.T. (Not High.)

Emma; lake, on Nipigon river, Thunder Bay district, Ont.

Emmerson; point, west side of Prince Rupert harbour, Coast district, B.C.

Empress; mountain, east of Sooke R., Vancouver I., B.C. (Not Conspicuous peak.)

Emulous; reef, off Ram I., Lockport harbour, Shelburne Co., N.S. (Not Emulow.)

End; mountain, south of the south fork of Ghost river, Rocky mountains, Alberta.

Endako; river, tributary to Stellako river, east of Francois lake, Coast district, B.C.

Endikai; lake, N.E. of Grasett Tp., Algoma district, Ont. (Not Endikai-a-go-ming.)

Endymion; island, Lake Fleet grp., St. Lawrence R., Leeds Co., Ont. (Not Endymian.)

English; portage, Pigeon river, above Grand portage, international boundary, Thunder Bay district, Ont.

English; river, rising near English River station, C.P.R., and flowing northward to L. Seul, and thence westward to its confluence with Winnipeg river, Kenora and Patricia districts, Ont.

English. See Churchill.

Englishman: lake and river, tributary to Saskatchewan river, central Saskatchewan.

Ennett; post office and railway station, Kent county, Ont. (Not Turnerville.)

Ennis; mount, east of mount Vaux, Rocky mountains, Kootenay district, B.C.

Ennishone; post settlement, Victoria county, N.B. (Not Ennishore.)

Ennishore. See Ennishone.

Enrage; cape, Chignecto bay, N.B. (Not Enragé.)

Ensley; creek, tributary to Yukon river, north of Indian river, Yukon.

Entrance; island, off Berry point, Gabriola island, S.E. coast of Vancouver I., B.C.

Epaule; rivière à l') river, Tewkesbury township, Quebec county, Que.

Equan See Ekwan.

Erickson; creek, railway station, and ridge, east of Michel, Kootenay district, B.C.

Erskine; mount, Saltspring island, southeast coast of Vancouver island, B.C.

Eschaillons. See Deschaillons.

Eskimo; bay, islands, and river, west of the strait of Belleisle, Saguenay county, Que. (Not Esquimaux.)

Eskimo; island, one of the Mingan group; Saguenay county, Que. (Not Esquimaux.)

Eskwahani; lake, near the headwaters of Ottawa river, Berthier and Joliette counties, Que. (Not Askwahani.)

Eskwanonwatin; lake, on Black Sturgeon river, south of lake Nipigon, Thunder Bay district, Ont. (Not Esquanonwatin.)

Esplanade; range of mountains in the Selkirks, Kootenay district, B.C.

Espoir (cap d'); cape, at entrance of Chaleur bay, Gaspe Co., Que. (Not Despair.)

Esquanonwatin. See Eskwanonwatin.

Esquimaux. See Eskimo.

Essington; town, at mouth of Skeena river, Coast district, B.C.(Not Port Essington.)

Etang. See L'Etang.

Etchipotchi; river, tributary to Waswanipi R., Abitibi, Que. (Not Eatchepashi.)

Ethel; lake, south of Mayo brook, Stewart river, Yukon.

Ethel; lake, Redditt township, Kenora district, Ont.

Etoimami. See Etomami.

Etoimami South. See Lilian.

Etomami; lake and river, tributary to Red Deer river, eastern Saskatchewan. (Not Etoimami nor Etoimami North.)

Etsi-kom. See Etzikom.

Etta; point, westerly extremity of Maurelle island, Coast district, B.C.

Etzikom; coulée, north of Milk river, southern Alberta. (Not Etsi-kom.)

Eulatazella; creek and lake, south of Nechako river, Cariboo district, B.C.

Eureka; creek, tributary to Indian river, Yukon.

Eva; lake, on N. T. railway, east side of Kenora district, Ont. (Not Wigwas.)

Eva; point, Devastation channel, Coast district, B.C.

Evain: lake, Montbelliard township, Timiskaming county, Que. (Not Kaishk.)
Evans; creek, west of Slocan lake, Kootenay district, B.C.
Evans; lake, in northern part of Abitibi territory, Que.
Evelyn; island, east of Warren island, Bruce county, Ont. (Not Birch.)
Evening; lake, southwest of Cliff lake, Kenora district, Ont.
Everest; island, Brock group, St. Lawrence river, Leeds county, Ont. (Not Sumach.)
Everett; reefs, at entrance to Timber bay, Manitoulin island, Manitoulin district, Ont.
Ewing; mount, west of Gladys lake, Cassiar district, B.C.
Execution. See Gallows.
Expanse; lake, an expansion of the upper Ottawa river, Timiskaming county, Que.
Exstew; Ry. sta., also river tributary to Skeena R., Coast district, B.C. (Not Ecstew.)
Extension; post office, west of South Wellington, Vancouver island, B.C.
Eyebrow; hills, lake, and post office, southern Saskatchewan.
Eyehill: creek, flowing into Manito lake, Alberta and Saskatchewan. (Not Eye Hill.)

F

Fagan; ground, S.W. of Yeo I., at entrance to Georgian bay, Manitoulin district, Ont.
Fairfield; bluff, on Yukon river, below Cudahy, Yukon.
Fairfield; post village and railway station, Leeds county, Ont. (Not Fairfield East.)
Fairfield: railway station, east of London, Middlesex county, Ont.
Fairfield East. See Fairfield.
Fairford; river, between Manitoba and St. Martin lakes, Man.
Fairground; post office, Norfolk county, Ont. (Not Fair Ground nor Fair Grounds.)
Fairholme: mountains, north of Bow river, Rocky Mountains park, Alberta.
Fair Ness; headland, at entrance to Markham bay, Hudson strait, N.W.T.
Fairview; mountain, south of lake Louise, Alberta. (Not Goat.)
Fairview; point, W. coast of Kaien island, Prince Rupert harbour, Coast district, B.C.
Fairway; channel, northwest of Gabriola island, southeast coast of Vancouver I., B.C.
Fairy; lake, east of Kejimkujik lake, Queens county, N.S.
Fairy. See Mamakwash.
Falcon; rock, at entrance to Prince Rupert harbour, Coast district, B.C.
Fall. See Tortue.
Falls; creek, west of Slocan lake, Kootenay district, B.C.
False; narrows, between Gabriola and Mudge islands, S.E. coast of Vancouver I., B.C.
False Detour; channel, between Cockburn and Drummond islands, Manitoulin district, Ont. The international boundary passes through the channel.
False Ducks; islands (2), at the south entrance to Prince Edward bay, L. Ontario, Prince Edward county, Ont. The distinctive names of these islands are "Swetman" for the eastern and "Timber" for the western—which see.
Fantail; lake and river, W. of Taku arm of Tagish L., Cassiar, B.C. (Not Otter.)
Farewell; cape, at the south end of Promise island, Coast district, B.C.
Farnam Corners; settlement, Missisquoi county, Que. (Not Farnam's Corners.)
Farnsworth; mount, east of O'Donnel river, Cassiar district, B.C.
Farquart; lake, Harcourt township, Haliburton county, Ont.
Farr; creek, emptying into northerly part of lake Timiskaming, Ont.

Farran Point; post village and Ry. station, Dundas Co., Ont. (Not Farran's Point.)

Farrell; lake, Rosebud district, Alberta. (Not Long.)

Farrier; river, flowing southeasterly into Primrose lake, central Alta. and Sask.

Fatigue; mountain, north of Mt. Assiniboine, Rocky Mountains park, Alberta.

Faucher; lake, Varsan township, Timiskaming county, Que. (Not Asapikona.)

Favel; lake, northeast of Silver lake, Kenora district, Ont.

Favourable; lake, southeast of Island lake, Patricia district, Ont.

Fawcett; lake, southeast of Williams bay L. Seul, Kenora district, Ont.

Fawcett; lake and river, tributary to Lesser Slave river, central Alberta. (Not Moose.)

Fawn; river, tributary to Severn river, Patricia district, Ont.

Fawn. See Woodtick.

Fay; mount, Bow range of the Rockies, Alta., and Kootenay district, B.C.

Fay; river, tributary to Klondike river, Yukon.

Felice; island, between Low peninsula and Stubbs island, Clayoquot sound, Vancouver island, B.C. (Not Round.)

Felucca; mountain, east of Blackwater range of the Rockies, Kootenay district, B.C.

Fenwick; creek, tributary to Wheaton river, southern Yukon.

Ferguson; point, on northerly side of Wolfe island, Frontenac county, Ont. (Not Pearson's nor Spardan.)

Ferguson Falls; post village, Lanark county, Ont. (Not Ferguson's Falls.)

Fergusson; mount, the highest point in the ridge to the northeast of the junction of Cadwallader creek with south fork of Bridge river, Lillooet district, B.C.

Ferme (île de la); islet, centre-most of 3 rocky islets in the St. Lawrence, off St. Germain, Kamouraska county, Que.

Fern; passage, east and south of Kaien island, connecting upper portion of Prince Rupert harbour with Chatham sound, Coast district, B.C.

Fernie; mountain ridge, also town, Kootenay district, B.C.

Ferroux; creek and mountain, north of Carmi, Similkameen district, B.C.

Feuz; a peak of mount Dawson, Selkirk mountains, Kootenay district, B.C.

Fèves (rivière des); river, Chateauguay county, Que.

Fiddlers Elbow; channel, between Lynedoch and Wallace islands, St. Lawrence river, Leeds county, Ont.

Field; lake, on Ross river, Yukon.

Field; mount, and railway station, Kootenay district, B.C.

Fife; creek, northwest of Whatshan lake, Kootenay district, B.C.

Fife; lake, Tp. 3, Rs. 29 and 30, W. 2 M., Saskatchewan.

Fifteen-mile. See Jennings.

Fighting; channel and island, Detroit river, Essex county, Ont.

Figuery; lake, Figuery township, Timiskaming county, Que.

File; hills, southeastern Saskatchewan.

File; lake and river, north of Reed lake, Manitoba.

File-axe; lake, on the height of land, S.E. of Mistassini lake, Mistassini territory, Q.

Findlay; island, north of Bathurst island, Arctic ocean. (Not Finlay Land nor King Christian island.) The name "King Christian," which has appeared on some recent maps, was given by Sverdrup, but the island had been previously named for

Alexander George Findlay, an eminent cartographer, and publisher of atlases, nautical directories, charts, etc. He was a member of the Council of the Royal Geographical Society for many years.

Finger; mountain, west of Bennett lake, Yukon.

Finlay. See Findlay.

Finlayson; arm, southern portion of Saanich inlet, Vancouver island, B.C.

Finlayson; lake and river, near head of Pelly R., Yukon. (Not Tle-tlan-a-tsoots.)

Finlayson; mount, S. of Finlayson arm, Vancouver island, B.C. (Not Leading peak.)

Fiord; bay, Separation lake, Kenora district, Ont.

Fir; river, tributary to Red Deer river, eastern Saskatchewan.

Fire; valley, west of Lower Arrow lake, Kootenay district, B.C.

Fish. See Arcola.

Fish. See Gap.

Fish. See Hébert.

Fish. See Incomappleux.

Fish. See Mami.

Fish. See Murphy.

Fish. See Norbury.

Fishbasket; river, emptying into Weibikwei lake, Patricia district, Ont.

Fisher; bay, northwest of Wakeham bay, Hudson strait, New Quebec.

Fisher; bay, northeast of Inner Duck island, Manitoulin district, Ont.

Fisher; creek, tributary to Wild Horse river, Kootenay district, B.C.

Fisher; creek, tributary to Sheep river, southern Alberta.

Fisher: harbour, north of Big island, Hudson strait, N.W.T.

Fisher; island, Brock group, St. Lawrence river, Leeds county, Ont.

Fisher; lake, east of Dryberry lake, Kenora district, Ont.

Fisher; lake, Timiskaming county, Que.

Fisher; mount, east of Kootenay river, Kootenay district, B.C.

Fisher; peak, southwestern Alberta.

Fisher; range of mountains, east of Kananaskis river, southern Alta. (Not Fisher's.)

Fisher; river, flowing northeasterly into the bay of the same name, L. Winnipeg, Man.

Fisherman; cove, at the north end of Gill island, Coast district, B.C.

Fishing; islands, extending from Chiefs point to Pike point, Bruce county, Ont. (Not Ghegheto.)

Fishing; lakes (4), expansions of Qu'Appelle river, Sask., the distinctive names being "Qu'Appelle," "Echo," "Lebret," and "Katepwe"—which see.

Fishtail; lake, Harcourt township, Haliburton county, Ont. (Not Fish Tail.)

Fitzwilliam; channel and island, entrance to Georgian bay, Manitoulin dist., Ont.

Five-finger; rapid, in Lewes river, below Nordenskiöld river, Yukon.

Flag, Flag's or Flagg's cove. See North Head harbour.

Flagstaff; hill, in Tp. 41, R. 11, W. 4 M., eastern Alberta.

Flamboro Centre; post village, Wentworth county, Ont. (Not Flamborough Centre.)

Flamboro East; township, Wentworth county, Ont. (Not East Flamboro nor Flamborough East.)

Flamboro West; post village and township, Wentworth county, Ont. (Not Flamborough West, West Flamboro nor West Flamborough.)

Flat; creek, tributary to Illecillewaet river, Kootenay district, B.C.

Flat; creek, tributary to Klondike river, Yukon.

Flat; point, east entrance to Sydney harbour, Cape Breton county, N.S. (Not Low.) (To avoid confusion with Low point and Low Point post office, Inverness county.)

Flat. See Ridley.

Flathead; range of mountains, Alta., and Kootenay district, B.C., also river, Kootenay district, B.C.

Flatland; harbour, island, and reef, west of Pie island, Thunder Bay district, Ont.

Fleet; point, Nanoose harbour, east coast of Vancouver island, B.C.

Fleming; island, southeast of Port Dover, Halifax county, N.S. (Not Fleming's.)

Fleming; peak, Hermit range of the Selkirks, Kootenay district, B.C.

Flemming; brook, tributary to Little R., Gloucester Co., N.B. (Not S. Br. of Little R.)

Fletcher; island, in Frobisher bay, N.W.T.

Fletcher; lake, in McClintock township, Haliburton county, Ont. (Not Fletcher's.)

Flint; lake, north of Kakagi lake, Kenora district, Ont.

Float; creek, tributary to Ottertail river, Rocky mountains, Kootenay district, B.C.

Float. See Downie.

Florence; river, tributary to Bell river, Abitibi territory, Que.

Florence; river, tributary to Klondike river, Yukon.

Flowerpot; island, east of Cove island, at entrance to Georgian bay, Bruce county, Ont. (Not Flower Pot.)

Fluke; lake, west of Cliff lake, Kenora district, Ont.

Foam; lake, Tps. 31 & 32, R. 12, W. 2 M., southeastern Saskatchewan.

Foamfall; river, tributary to Ashuapmuchuan river, Chicoutimi county, Que.

Fog; lake, west of Manitou lake, Kenora district, Ont.

Folden; settlement, Oxford county, Ont. (Not Folden's Corners.)

Folden's Corners. See Folden.

Folding; mountain, southeast of Brulé lake, central Alberta.

Follé; mountain, between Watson and Wheaton rivers, southern Yukon.

Folly. See Fort Folly.

Footprint; lake and river, N. of Threepoint L., Manitoba. (Not Squirrel nor Weir.)

Forbes; mount, southeast of Mt. Lyell, Rocky mountains, Alberta.

Fording; river, tributary to Elk river, Kootenay district, B.C.

Foreleg; bay, in Atikwa lake, Kenora district, Ont. (Not Little Jackfish.)

Forest; lake, west of Whitney lake, Kenora district, Ont.

Foresters; island, in the bay of Quinte, Prince Edward county, Ont. (Not Captain John's island.)

Fork; lake, Tp. 63, R. 11, W. 4 M., eastern Alberta.

Fork; river, tributary to Mossy river, south of L. Winnipegosis, Man.

Forks; lake, on Churchill R., below Stanley mission, Sask. (Not Rapid River lake.)

Forks of Credit. See Credit Forks.

Forsyth; island, Admiralty group, St. Lawrence R., Leeds county, Ont. (Not Quarry.)

Fort Chimo. See Chimo.

Fort Chipewyan. See Chipewyan.

Fort Dunvegan. See Dunvegan.

Fort Edmonton. See Edmonton.

Fort Folly; point, between Memramcook and Petitcodiac rivers, Westmorland county, N.B. (Not Folly.)

Fort Frances; village and H. B. Co. post, on Rainy river, Rainy River district, Ont. (Not Fort Francis.)

Fort Fraser. See Fraser.

Fort James. See Fort St. James.

Fort Lennox. See Noix.

Fort McKay. See McKay.

Fort Macleod. See Macleod.

Fort McMurray. See McMurray

Fort Nelson; river, tributary to Liard river, Cariboo district, B.C. (Not Nelson.)

Fortress; lake, at head of Wood river, also mountain north of the east end of the lake, Rocky mountains, Alberta.

Fort St. James; H. B. Co. post, Mining Record office, and P. O., near the outlet of Stuart lake, Coast district, B.C. (Not Fort James.)

Fort St. John; H. B. Co. post, on Peace river, Cariboo district, B.C.

Fort Selkirk. See Selkirk.

Fort Severn; See Severn.

Fort Smith; H. B. Co. post, also post settlement on Slave river, northern Alberta.

Fort Wallace; island, Lake Fleet group, St. Lawrence river, Leeds county, Ont.

Fort William; city, Thunder Bay district, Ont.

Fortymile; river and town, Yukon. (Not Forty Mile.)

Fossil; mountain, southwest of mount Douglas, Rocky mountains, Alberta.

Foster's. See Deception.

Fosthall; creek, west side of Upper Arrow lake, Kootenay district, B.C.

Fouquette; river, flowing into the St. Lawrence, below St. André, Kamouraska county, Que.

Fourchu; harbour, Cape Breton county, N.S. (Not Fourché nor Fourchou.)

Four-mile. See Lakit.

Fournier; post village, Prescott county, Ont. (Not Fournierville.)

Fowl; point and portage, international boundary, Thunder Bay district, Ont.

Fox; mount, also glacier, in the Selkirks, B.C.

Fox; island, Weller bay, Ameliasburg township, Prince Edward county, Ont.

Fox; island, in lake Simcoe, York county, Ont. (Not Snake.)

Fox; islands, Gordon bay, N.W.T. (Not West Fox.)

Fox; land, S.W. portion of Baffin I., Gordon bay, N.W.T. (Not Foxe nor Luke Fox.)

Fox. See Gordon.

Foxe. See Fox.

Framboise; village, Richmond county, N.S. (Not Frambois.)

Français. See Francois.

Frances; lake and river, southeastern Yukon.

Frances Smith; shoal, entrance to Key harb., Georgian bay, Parry Sound dist., Ont.

Francis; island, between Grindstone and Wolfe islands, St. Lawrence river, Frontenac county, Ont. (Not Hickory.)

Francis; island, west side of entrance to Ucluelet arm, Barkley sound, Vancouver island, B.C. (Not Round.)

Francisco; point, southeast end of Quadra island, Coast district, B.C.

François; lake, south of Babine lake, Cassiar and Cariboo districts, B.C. (Not Français.) Reversal of previous decision.

Frank; lake, south of N. T. Ry., northeast of L. Nipigon, Thunder Bay district, Ont.

Frank Clark. See Clark.

Franklin. See Shawanaga.

Franktown; post village and railway station, Lanark county, Ont. (Not Frankstown.)

Fraser; lake, Carlow township, Hastings county, Ont. (Not Fraser's.)

Fraser; lake, H. B. Co. post, and telegraph station, south of Stuart lake, Cariboo district, B.C. (Not Nalta lake, nor Fort Fraser post and station.)

Fraser; point, southerly coast of Digby island, Coast district, B.C.

Fraser; reach, northeast of Princess Royal island, Coast district, B.C.

Fraser; river, central and southern British Columbia.

Fraser. See Frazer.

Fraserville; town, Temiscouata county, Que. (Not Frazerville.)

Frazer; creek and lake, S. of L. Nipigon, Thunder Bay district, Ont. (Not Fraser.)

Frazer; island, Becher bay, southern coast of Vancouver island, B.C. (Not Fraser.)

Frazerville. See Fraserville.

Fréchette; bay, bank, and point, near Misery bay, Manitoulin district, Ont.

Fréchette; lake, Desandroins and Montbelliard townships, Timiskaming county, Que. (Not Merrill.)

Fréchette. See Dombourg.

Freda. See Freya.

Frederick; lake, Halifax county, N.S. (Not Pine Wood.)

Frederick; lake, west of Kusawa lake, southwestern Yukon.

Frederick; point, east coast of Digby island, Prince Rupert harbour, Coast district, B.C.

Frederick; point, Pittsburgh township, Frontenac county, Ont.

Freeman's. See Freemen.

Freemen; lake, and river tributary to Athabaska river, Alta. (Not Freeman's.)

Freestone. See Gregory.

Frenchman; bay, Ontario county, Ont. (Not Pickering harbour.)

Frenchman; lake, Tp. 64, R. 10, W. 4 M., eastern Alberta.

Frenchman; river, in southern Saskatchewan. (Not White Mud.)

Freshfield; mount, north of Blaeberry river, Rocky Mts., Kootenay district, B.C.

Fresno; creek, tributary to Yukon river, below Dawson, Yukon.

Freya; a spur of the Valhalla mountains, Kootenay district, B.C. (Not Freda.)

Friday; creek, branch of Sulphur creek, Indian river, Yukon.

Friday; lake, southwest of Lorrain township, Timiskaming district, Ont.

Frigate; mountain, N.E. of Blackwater range of the Rockies, Kootenay district, B.C.

Fritz; landing, on east side of Lower Arrow lake, Kootenay district, B.C.

Frobisher; bay, in S.E. portion of Baffin island, N.W.T. (Not Lumly inlet, &c.)

Frobisher; post office and railway station, southeastern Sask. (Not Frobyshire.)

Frog; lake, and Frog Lake Indian reserve, eastern Alberta.
Frostfish; cove, in N.E. portion St. Margaret bay, Halifax Co., N.S. (Not Frost Fish.)
Froude; bay, northeast of McKim bay, Manitoulin island, Manitoulin district, Ont.
Fuller; lake, south of Chemainus, Vancouver island, B.C. (Not Howe.)

G

Gabarus; bay, cape, and P.O., Cape Breton Co., N.S. (Not Gabarous nor Gabaróuse.)
Gaboury; lake, Bauneville and Vilars townships, Timiskaming county, Que. (Not Little Roger.) Previous decision revised.
Gabriel; island, Frobisher bay, N.W.T. (Not Gabriell.)
Gabriel; strait, between Resolution I. and mainland, N.W.T. (Not Tudjakdjudusirn.)
Gabriola; island, passage, and reefs, east of Nanaimo, B.C.
Gaetz; cove, east side of Mahone bay, Lunenburg county, N.S.
Gage. See Ninemile.
Gage. See Simcoe.
Gainsborough; creek, tributary to Souris R., Manitoba and Sask. (Not North Antler.)
Gainsborough; township, Lincoln county, Ont. (Not Gainsboro.)
Galbraith; creek, tributary to Bull river, Kootenay district, B.C. (Not West fork of Bull river.)
Gale. See Peter.
Galena; bay, at north end of Upper Arrow lake, Kootenay district, B.C. (Not Thumb.)
Galena; creek, tributary to Yukon river, below Indian river, Yukon.
Galiano; island, and Galiano gallery near Descanso bay, Gabriola island, strait of Georgia, New Westminster district, B.C. (Not Malaspina's gallery.)
Galiano. See Nigei.
Galloway; rapids, between Morse and Wainwright basins, southeast of Kaien island, Coast district, B.C.
Galloway; settlement, Kent Co., N.B. (Not Galway, New Galway, nor New Galloway.)
Gallows; point, south extreme of Protection island, southeast coast Vancouver island, B.C. (Not Execution.)
Galop; canal, island, and rapids, St. Lawrence river, Dundas county, Ont. (Not Gallop, Gallops, Gallopes, Galoup, nor Galloup.)
Galt; creek, flowing into Grand river; Waterloo, Wellington, and Wentworth counties, Ont. (Not Mill.)
Galton; range of mountains, west of Wigwam river, Kootenay district, B.C.
Galway. See Galloway.
Gamskagamik; lake, south of lake Hill, Kenora district, Ont. (Not Painkiller.)
Gaotanaga; lake, west of Grand lake Victoria, Timiskaming county, Que.
Gap; creek, tributary to Maple creek, southwestern Saskatchewan. (Not Fish.)
Garden; island, N.E. of Du Vernet Pt., Digby I., Prince Rupert harb., Coast dist., B.C.
Garden; island, north of Wolfe island, St. Lawrence river, Frontenac county, Ont.
Garden Island. lake, north of Matchimanitou lake, Pontiac county, Que.
Garden; river, tributary to the Saskatchewan, east of Birson, Sask. (Not Sucker.)
Gardner; canal, Devastation channel, Coast district, B.C. (Not Gardiner.)

Garibaldi; hill, west of Pedder bay, Vancouver island, B.C. (Not North peak.)

Garnet; creek, tributary to Dominion creek, Indian river, Yukon.

Garnet; mountain, west of mount Goodsir, Rocky mountains, Kootenay district, B.C.

Garrett; island, N.W. Lynedoch I., St. Lawrence R., Leeds Co., Ont. (Not Garrett's.)

Garry; lake and river, tributary to Delisle R., Glengarry Co., Ont. (Not Black lake.)

Garson; lake and river, Alta. and Sask. (Not Swan lake nor Whitefish lake and river.)

Garthby; post village, railway station, and township, Wolfe county, Que. (Not Garthby Station P.O.)

Garthby Station. See Garthby.

Gasline; post office, Welland county, Ont. (Not Gas Line.)

Gaspe (Eng.) **Gaspé** (Fr.); bay, cape, county, and town, Que. (Not Gaspa, Gaspee, nor Gaspey.)

Gaspereau; lake, also river tributary to Salmon river, Queens and Sunbury counties, N.B. (Not Gaspereaux.)

Gaspereau; river, flowing into baie Verte, Westmorland Co., N.B. (Not Gaspereaux.)

Gaspesia; shoal, southeast of Walkhouse point, Manitoulin district, Ont.

Gat; point, on western part of Cove I., at entrance to Georgian bay, Bruce county, Ont.

Gatacre; point, south shore of Manitoulin island, Manitoulin district, Ont.

Gates; island, west of Howe island, St. Lawrence river, Frontenac county, Ont.

Gateway; post village and railway station, Int. boundary, Kootenay district, B.C.

Gatineau Point; village, at the mouth of Gatineau river, Ottawa county, Que.

Gaudet. See Grindstone.

Gaudin; point, Devastation channel, Coast district, B.C.

Gauley; bay, northeast of Greenough point, Bruce county, Ont.

Gawjewiagwa; lake, east of Anzhekumming lake, Kenora district, Ont.

Geikie; creek and glacier, N. of Dawson glacier, Selkirk Mts., Kootenay district, B.C.

Geikie; island, L. Nipigon, Thunder Bay district, Ont. (Not White's.)

Geikie; lake, east of lake Evans, Abitibi territory, Que.

Gem; lake, in McGarry township, Timiskaming district, Ont.

Genesta; reef, S. of Maiden I., S. shore of Manitoulin I., Manitoulin district, Ont.

Gens-de-terre; river, tributary to Gatineau river, Ottawa and Pontiac counties, Que. (Not Jean de Terre.)

George; bay and cape, Northumberland strait, Antigonish Co., N.S. (Not St. George.)

George; creek, tributary to the south branch of Brazeau river, central Alberta.

George; island, Halifax harbour, Halifax county, N.S. (Not Georges nor George's.)

George; lake, Prescott county, Ont. (Not Georges nor Georgian.)

George; river, flowing into Ungava bay, New Quebec. (Not Kangerthialuksoak.)

George; point, at east entrance to Black bay, Thunder Bay district, Ont.

George. See Gorge.

George. See St. George.

Georgia; lake, southeast of lake Nipigon, Thunder Bay district, Ont.

Georgia; rock, at entrance to Prince Rupert harbour, Coast district, B.C.

Georgia; strait of, between Vancouver island and the mainland, B.C. (Not Gulf of Georgia.)

Georgian; bay, the northeastern portion of lake Huron, Ont.

Georgina; island, north of Hill island, St. Lawrence river, Leeds county, Ont. (Not Catline nor Deer.)

Germain; island, E. of Dokis I., entrance to Key harbour, Parry Sound dist., Ont.

German Mills; post village, Waterloo county, Ont. (Not German Mill.)

Gertrude; point, Douglas channel, near Kitkiata, Coast district, B.C.

Ghegheto. See Fishing.

Ghost; island, between Jeannette island and the Millar group, North channel, Queen Charlotte sound, Coast district, B.C. (Not Round island.)

Ghost; lake, north of Wabigoon lake, Kenora district, Ont.

Ghost; river, tributary to Bow river, Alberta.

Ghost. See Spirit.

Ghostpine; creek, tributary to Red Deer river, Alberta. (Not Devil's Pine.)

Ghostpine; lake, Tp. 36, Rs. 24 and 25, W. 4th M., Alberta. (Not Devil's Pine.)

Gibraltar; peak, Adamant range, Selkirk mountains, Kootenay district, B.C.

Gibraltar. See Harvey.

Gig; island, Lake Fleet group, St. Lawrence river, Leeds county, Ont.

Gil; island, northwest of Princess Royal island, Coast district, B.C. (Not Gill.)

Gilbert; railway station, Kenora district, Ont.

Gillies; lake and railway station, southwest of Cobalt, Ont. (Not Mud lake.)

Gilphie; reef, off Pine Tree harbour, Bruce county, Ont.

Gimli; a peak of the Valhalla mountains, Kootenay district, B.C.

Girouard; mount, south of Mt. Inglismaldie, Rocky Mountains park, Alta.

Girouard; point, north of Western Duck island and west of Rickley harbour, Manitoulin district, Ont. (Not East Belanger.)

Giroux; island, St. Lawrence river, Soulanges county, Que. (Not Dadancour.)

Giroux; lake and post office, southeast of Cobalt, Timiskaming district, Ont.

Gizzard; river, tributary to Bell river, Abitibi territory, Que.

Glacier; creek, a branch of Gold creek, Yukon.

Glacier; lake, near Howse pass, Rocky mountains, Alberta.

Glacier; point, west of Sheringham point, Juan de Fuca strait, Vancouver island, B.C. (Not Point-no-Point.)

Glacier. See Peyto.

Glacier. See Yoho.

Glacier Crest; mountain, Selkirk mountains, Kootenay district, B.C.

Gladman; mount, on Yukon river, near the international boundary, Yukon.

Gladsheim; a peak of the Valhalla mountains, Kootenay district, B.C.

Gladstone; creek, east of Lower Arrow lake, Kootenay district, B.C.

Gladys; lake and river, southwest of Teslin lake, Cassiar district, B.C. (Not Sucker lake, nor North river.)

Glaises (rivière aux); river, flowing into the St. Lawrence, above Pte du Lac, St. Maurice county, Que. (Not Loutres.)

Glasgow; island, in North bay, Hudson strait, N.W.T.

Glave; mount, near upper waters of Chilkat river, Cassiar district, B.C.

Glenallan; village, Wellington county, Ont. (Not Glen Allan.)

Glenbrook; post office, Glengarry county, Ont. (Not Glen Brook.)

Glencoe; island, northwest of Strathcona islands, Hudson strait, N.W.T.

Glencolin; village, Elgin county, Ont. (Not Glen Colin.)

Glenelbe; post office, Leeds county, Ont. (Not Glen Elbe.)

Glengarry; point, also Glengarry Point lightstation, opposite lower end of St. Regis island, Glengarry county, Ont. (Not Stonehouse.)

Glenhuron; village, Simcoe county, Ont. (Not Glen Huron.)

Glenlyon; mountains and river, Pelly river, Yukon.

Glennevis; village, Glengarry county, Ont. (Not Glen Nevis.)

Glenogle; creek and railway station, Kootenay district, B.C.

Glenora; village, on Stikine river, below Telegraph creek, Cassiar district, B.C.

Glenroy; post office and railway station, Glengarry county, Ont. (Not Glen Roy.)

Glensutton; P.O. and Ry. station, Brome Co., Que. (Not Glen Sutton nor Glenton.)

Glenwillow; post settlement, Metcalfe Tp., Middlesex Co., Ont. (Not Glen Willow.)

Glycerine; rock, South bay, Manitoulin island, Manitoulin district, Ont.

Gnat; creek, tributary to Klondike river, Yukon.

Gnat; river, at south end of Kootenay lake, Kootenay district, B.C.

Goacha. See Maguasha.

Goat; range of mountains, east of Spray river, Rocky Mountains park, Alberta.

Goat. See Bow.

Goat. See Fairview.

Goat. See Teresa.

Goat Canyon; creek, tributary to Caribou creek, Kootenay district, B.C.

Goatfell; railway station, Kootenay district, B.C.

Gobeil; island, north of Coste island, Kitimat arm, Coast district, B.C.

Goble; post office, Oxford county, Ont. (Not Goble's.)

Godbout; river, Saguenay county, Que. (Not Godbret nor Goodbout.)

Goderich; town, Huron county, Ont.

Godfroy; river and seigniory, Nicolet county, Que. (Not Godfroi, Godefroi, nor Godefroy.)

Gods; lake and river, northeast of L. Winnipeg, draining into Hays R., Manitoba.

God's Mercie; islands of, north shore of Hudson strait, N.W.T. This name was also applied at one time to the island now known as "Middle Savage."

Gods Mercy; bay of, Southampton island, Hudson bay, N.W.T.

Gold; creek, tributary to Sixtymile river, Yukon.

Gold; creek, flowing into Kootenay river, opposite Flagstone, Kootenay district, B.C.

Gold; range of mountains, west of Columbia river, B.C.

Gold; river, flowing into Columbia river, above Bush river, Kootenay district, B.C.

Goldbottom; creek, branch of Hunker creek, a tributary to Klondike river, Yukon.

Golden; creek, branch of Henderson creek, north of Stewart river, Yukon.

Golden; valley, southeast of Pike bay, Bruce county, Ont.

Golden Horn; mountain, southwest of Lewes river, Yukon.

Golden Mountain (settlement). See Gowland Mountain.

Goldfinch; lake, upper waters of Lievre river, St. Maurice county, Que.

Gold-run; creek, tributary to Dominion creek, Indian river, Yukon.

Goldsmith; river, tributary to Driftpile river, central Alberta.

Goldstream; lakes and river, emptying into Finlayson arm, Vancouver island, B.C.

Goldstream; glacier, mountain, and névé, west of mount Sir Sandford, also river flowing westerly into Columbia river. Selkirk mountains, Kootenay, B.C.

Gonzales; hill and point, east of Victoria, B.C. (Not Shotbolts.)

Goodbout. See Godbout.

Goodsir; mount, also creek, S.E. of Mt. Vaux, Rocky Mts., Kootenay district, B.C.

Goodwin; creek, flowing east into Teslin lake, Cassiar district, B.C.

Goodwin; lake, Lorrain township, Timiskaming district, Ont.

Goose; cape, below Coudres island, St. Lawrence river, Charlevoix county, Que. French usage: Oies (cap aux), which see.

Goose; point, south shore Manitoulin island, Manitoulin district, Ont.

Goose. See Granby.

Goose. See Grey Goose.

Goose. See Primrose.

Gooseberry. See Marjorie.

Goosehunting; creek, tributary to Carrot river, Sask. (Not Maple river.)

Gordon; bay, west of Chorkbak inlet, Hudson strait, N.W.T. (Not Fox.)

Gordon; brook, west of Lower Arrow lake, Kootenay district, B.C.

Gordon; island, N. of Lake Fleet group, St. Lawrence R., Leeds Co., Ont. (Not Citron.)

Gordon; lake, east of Linklater lake, Kenora district, Ont.

Gordon; lake, Tp. 45, R. 10, W. 3 M., Saskatchewan.

Gordon; mount, near Stikine river, south of Telegraph creek, Cassiar district, B.C.

Gordon; mount, northwest of mount Balfour, Rocky mountains, Alta. and B.C.

Gorge; creek, tributary to Deadman river, Kamloops district, B.C. (Not George.)

Gorge; creek, tributary to Sheep river, southern Alberta.

Gorman; lake, Brudenell township, Renfrew county, Ont.

Gothics; group of peaks, Adamant range, Selkirk mountains, Kootenay, B.C.

Goudron; river, tributary to Kamouraska river, Kamouraska county, Que.

Gough; lake, south of Battle river, Alberta.

Goulbourn; post office and township, Carleton county, Ont. (Not Goulbourne.)

Goulbourne. See St. Helena.

Gould Dome; mountain, Rocky Mts., southwestern Alberta. (Not Gould's Dome.)

Gounamitz. See Gunamitz.

Gourdeau; island, north of Swede island, Thunder Bay district, Ont.

Govan; brook, Bruce harbour, Hudson strait, N.W.T.

Gowganda; lake, mining division, and post office, Timiskaming district, Ont. (Not Gow Ganda.)

Gowland Mountain; post settlement, Albert county, N.B. (Not Golden Mountain.)

Grace; creek, tributary to Fording river, Kootenay district, B.C.

Grace; lake, Dudley township, Haliburton county, Ont.

Grace; lake, in Skead township, Timiskaming district, Ont.

Graeme. See Pulteney.

Graham; creek, tributary to Souris river, southern Manitoba and Saskatchewan.

Graham; creek and inlet, west of Atlin lake, Cassiar district, B.C. (Not Taku inlet.)

Graham; mount, Selkirk range, Kootenay district, B.C.

Graham. See Lavigne.

Graisse, rivière a la. See Rigaud.

Gramophone; creek, flowing into Bulkley R., above M[illegible]town, Coast district, B.C.

Grampus. See Mosher.

Granby; bay, west of Larcom island, Observatory inlet, Cassiar district, B.C. (Not Goose nor Xschwan.)

Granby; point, southern entrance to Granby bay, Observatory inlet, Cassiar, B.C.

Grand; glacier and mountain, S.E. of Purity range, Selkirk Mts., Kootenay dist., B.C.

Grand; point and reef, Brulé bay, Thunder Bay district, Ont. (Not Brulé.)

Grand. See Black.

Grand See DeSalaberry.

Grand. See Dumoine.

Grand. See Kelvin.

Grand. See Shubenacadie.

Grandboro; post village, Shefford county, Que. (Not Grandborough.)

Grande Anse; bay, Gaspe county, Que. (Not Grand.)

Grande-Anse; post village, Gloucester county, N.B. (Not Grand Anse.)

Grande Batture. See Leonard.

Grande Ile aux Erables. See De Beaujeu.

Grande-Prairie; post settlement, central Alberta.

Grand-Etang; town, Inverness county, N.S. (Not Grande Etang.)

Grand Forks; town and railway junction, on Kettle river, Similkameen district, B.C.

Grand Lac du Commissaires. See Thirty-one-mile.

Grand Lake Jacques Cartier. See Jacques Cartier.

Grand lake Victoria; upper waters of Ottawa river, Timiskaming county, Que.

Grand Manan; island, Charlotte county, N.B. (Not Menan.)

Grand Manan. See North Head.

Grand Manitoulin. See Manitoulin.

Grand Rustico. See North Rustico.

Grand Valley; creek, tributary to Bow river, Alberta.

Granger; mountain, west of Coal lake, southern Yukon.

Granite; creek, flowing into Quiet lake, southeastern Yukon.

Granite; creek, tributary to Caribou creek, Kootenay district, B.C.

Granite Creek; post office, on creek of same name, S.E. of Tulameen, Yale dist., B.C.

Granite; lake, west of Smoothrock lake, Thunder Bay district, Ont

Granite; point, northwesterly extremity of Quadra island, Coast district, B.C.

Granite; river, flowing southwesterly into lake of same name on international boundary, Thunder Bay district, Ont.

Grant; peak, Hermit range, Selkirk mountains, Kootenay district, B.C.

Grant; point, southwest point of Maitland island, Coast district, B.C.

Grant. See Dunn.

Grant Corners; village, Glengarry county, Ont. (Not Grant's Corners.)

Grantham; shoals, southeast of Todman reef, Manitoulin I., Manitoulin district, Ont.

Grant Land. See Ellesmere.

Granville; lake, on Churchill river, Manitoba. (Not Grenville.)

Grape; island, Muscote bay, N.E. of Huff I., bay of Quinte, Prince Edward Co., Ont.

Grape. See Rose.

Grasett; railway station and township, Algoma district, Ont. (Not Grassett.)

Grass; river, tributary to Nelson river, Manitoba.

Grass. See Kiskitto.

Grass. See Rose.

Grassberry; river, flowing southerly into Cumberland lake, central Saskatchewan.

Grassey's Corners. See Grassie.

Grasshopper; mountain, north of Tulameen river, Yale district, B.C.

Grassie; village, Lincoln county, Ont. (Not Grassies nor Grassey's Corners.)

Grassy; point, in northeastern portion of Sophiasburg Tp., Prince Edward Co., Ont.

Grassy. See Bronson.

Grassy. See Caldwell.

Grassy River (lake). See Stanawan.

Gratton Corners; P.O., Prescott Co., Ont. (Not Gratton Corner nor Gratton's Corner.)

Grave; creek, tributary to Elk river, below Fording river, Kootenay district, B.C.

Grave. See Wapiabi.

Gravel; point, on eastern side of Great Duck island, Manitoulin district, Ont.

Gravel; river, tributary to Mackenzie river, N.W.T.

Gravelly. See Ostrander.

Gray; an elevation of ground locally known as "Gray island," on west side of Petitcodiac river, Albert county, N.B. (Not Gray's nor Grey.)

Gray; mount, also ridge, north of Bennett lake, Yukon.

Gray; strait, at eastern entrance to Hudson strait, New Quebec.

Grays; creek, flowing into Crawford bay, Kootenay, B.C. (Not Greys.)

Gray Wolf; mountain, north of the Valhalla mountains, Kootenay district, B.C.

Great. See Hamilton.

Great Bear; lake and river, Mackenzie, N.W.T. (Not Bear nor Great Bear Lake river.)

Great Bear Sand hills. See Wapawekka.

Great Beaver; lake, at headwaters of St. Maurice river, Champlain county, Que.

Great Bishop Roggan. See Roggan.

Great Black. See Hecla.

Great Bras d'Or; channel, northwest of Boularderie island, extending to Barra strait from the Atlantic, Cape Breton and Victoria counties, N.S.

Great Bras d'Or lake. See Bras d'Or lake.

Great Cataraqui. See Cataraqui.

Great Duck; island, the largest of the Duck island group, Manitoulin district, Ont.

Great Fish. See Backs.

Great Metis. See Metis.

Great New. See Long.

Great Opeongo. See Opeongo.

Great Shemogue. See Shemogue.

Great Tusket. See Tusket.

Greece Point; post village, Argenteuil Co., Q. (Not Græca Point nor Greece's Point.)

Green; creek, branch of Sulphur creek, Indian river, Yukon.

Green; island, with lightstation thereon, southeast of Madame island, Richmond county, N.S.

Green; lake and river, emptying into west end of Lillooet lake, Lillooet district, B.C.
Green; mount, southwest of Ross peak, Selkirk mountains, Kootenay district, B.C.
Green point, northeast extremity of Sophiasburg township, Prince Edward county, Ont.
Green; point, north of Inner Duck island, Manitoulin district, Ont.
Green. See Country.
Green. See Pearl.
Green. See Victoria.
Greenan; lake, Jones township, Renfrew county, Ont. (Not Greenan's.)
Greenbush; lake, southeast of lake St. Joseph, Thunder Bay district, Ont.
Green Cove. See Port Maitland.
Greene; island, N.W. of Western Duck I., Manitoulin district, Ont. (Not Green's.)
Greene Island; harbour, Manitoulin island, Manitoulin district, Ont.
Greenfield; shoal, S. of Turning island, entrance to Georgian bay, Bruce county, Ont.
Greenough; bank, harbour, and point, S.E. of Pine Tree harbour, Bruce county, Ont.
Green Point; post settlement and railway station, Gloucester county, N.B.
Greens; glacier, in the Selkirk mountains, Kootenay district, B.C. (Not Green.)
Green's. See Terminal.
Greenshields; lake, on Severn river, Patricia district, Ont.
Greenwood Land; at head of Frobisher bay, N.W.T. (Not Greenwood's.)
Green Valley. See Verte-Vallée.
Gregg; creek and lake, between Athabaska and Baptiste rivers, Alta. (Not Lower White Fish.)
Gregory; island, northwest of Doctor island, St. Peters inlet, Richmond county, N.S. (Not Freestone islet.)
Grenadier; island, in St. Lawrence river, Leeds county, Ont. (Not Bathurst.)
Grenville. See Granville.
Grey; island, N. of Edward I. and S. of entrance to Black bay, Thunder Bay dist., Ont.
Grey. See Gray.
Grey Goose; island, opposite mouth of Big river, James bay, Que. (Not Goose.)
Greys. See Grays.
Gribbell; island, between Ursula channel and Verney passage, Coast district, B.C.
Grice; point, N.W. extreme of Low peninsula, Clayoquot sound, Vancouver I., B.C.
Griffin; bay, southwest shore Frobisher bay, N.W.T.
Griffin; mount, southwest of Griffin lake, Kamloops district, B.C.
Grimross; islands, in St. John river, Queens county, N.B. (Not Grimrose.)
Grimsthorpe; lake, Grimsthorpe township, Hastings county, Ont. (Not Wolf.)
Grindstone; creek, tributary to Petitcodiac river, above Upper Dover, Westmorland county, N.B. (Not Gaudet.)
Grindstone; island and point, northeast coast of Digby island, Coast district, B.C.
Grindstone; lake, Redditt township, Kenora district, Ont.
Grindstone; point, east entrance of Washow bay, lake Winnipeg, Manitoba.
Grinnell; glacier, southwest shore of Frobisher bay, N.W.T.
Grinnell; peninsula, northwesterly portion of Devon I., N.W.T. (Not Grinnell Land.)
Grinnell Land. See Ellesmere.
Griswold; island and shoals, east of Bridge island, St. Lawrence river, Yonge township, Leeds county, Ont. (Not East Chimney Island shoals.)

Grizzly Bear. See Landels.

Grizzly; bluff, near the mouth of Teslin river, Yukon. (Not Grizzly Bear Bluff.)

Grizzly; mountain, in the Selkirks, Kootenay district, B.C.

Grog; island, in Batteau channel, N. of Howe I., St. Lawrence R., Frontenac Co., Ont.

Groswater. See Melville.

Grotto; mountain, east of Canmore, Rocky Mountains park, Alberta.

Grove; island, northeast of Huff island, bay of Quinte, Prince Edward county, Ont.

Grundy; creek, east of Kootenay river, north of Steele, Kootenay district, B.C.

Gryphon; lake, southwest of W[illegible]vo lake, Kenora district, Ont.

Guano; rock, southwest of Dead island, at entrance to Key harbour, Georgian bay, Parry Sound district, Ont.

Guaquina. See Muchalat.

Guard; island, Southgate group, Queen Charlotte sound, Coast district, B.C.

Guard. See Gurd.

Guardsman; mountain, northeast of Mt. Sir Sanford, Selkirk mountains, B.C.

Guide. See De Watteville.

Gull; lake, east of Pelly lakes, Yukon.

Gull. See Barbara.

Gull. See Cavalier.

Gull. See Charwell.

Gull. See Ella.

Gull. See Kaiashk.

Gull. See Mississagua.

Gullrock; lake, southeast of Red lake, Patricia district, Ont. (Not Gull Rock.)

Gulquac; river, tributary to Tobique river, Victoria county, N.B.

Gun; creek and lake, tributary to Bridge river, Lillooet district, B.C. (Not Gunn.)

Gun; lake, north of Nahlin river, Cassiar district, B.C.

Gunamitz; river, tributary to Restigouche R., N.B. (Not Gounamitz, nor Little Fork.)

Gunflint; lake, international boundary, Thunder Bay district, Ont. (Not Gun Flint.)

Gunliffe. See Cunliffe.

Gunn; point, south of Douglas point, Bruce county, Ont.

Gunn. See Gun.

Gunter; lake, Cashel township, Hastings county, Ont. (Not Gunter's.)

Gurd; island, Kitkatlah inlet, Coast district, B.C. (Not Guard.)

Gustavus; mountains, between Mayo L. and Laduc and McQuesten rivers, Yukon.

Guysborough; county and town, N.S. (Not Guysboro.)

Gyrfalcon; islands, south coast Ungava bay, New Quebec.

Gzowski; lake, north of N. T. R. and east of Robinson L., Thunder Bay district, Ont.

H

Habel; mount, S.W. of Mt. Collie, Rocky Mts., Kootenay district, B.C. (Not Hidden.)

Habitants See Inhabitants.

Hache; (rivière à la) river, tributary to Tête-Blanche river, Chicoutimi county, Que.

Hackett; cove, also Hackett Cove village, east shore of St. Margaret bay, Halifax county, N.S. (Not Hackett's Cove village, nor Haggert cove.)

Hackett; river, tributary to Sheslay river, Cassiar district, B.C.

Haddo; peak of mount Aberdeen, Rocky mountains, Alberta.

Haeckel; hill, near the confluence of Lewes and Takhini rivers, Yukon.

Hagerman; post village, York county, Ont. (Not Hagerman's Corners.)

Haggart; creek, tributary to Johnston creek, McQuesten river, Yukon.

Haggert. See Hackett.

Ha Ha; bay, lake, and river, Chicoutimi Co., Q. (Not Bay Ha Ha, nor Baie des Ha Ha.)

Haileybury; town, Timiskaming district, Ont.

Hair. See Nechigona.

Hair Cutting; lake and river, at headwaters of St. Maurice R., Champlain Co., Que.

Halcro; mountain peak, east shore of Atlin lake, Cassiar district, B.C.

Halcyon; mountain and post office, east of Upper Arrow lake, Kootenay district, B.C. (Not Halcyon Hot Springs post office.)

Haldane; mount, near Mayo brook, Stewart river, Yukon.

Hale; creek, near south end of Taku arm of Tagish lake, Cassiar district, B.C.

Haliburton; lake, Harburn township, Haliburton county Ont,

Hall; brook, harbour, and point, Kings county, N.S. (Not Hall's.)

Hall; creek, tributary to west fork of Kettle river, Similkameen district, B.C.

Hall; island, southeast of Reid island, southeast coast of Vancouver island, B.C.

Hall Harbour; post office, Kings county, N.S. (Not Hall's Harbour.)

Hall; lake, northwest of Cliff lake, Kenora district, Ont.

Hall; lake and river, W. of Teslin L., Cassiar dist., B.C. and Yukon. (Not North river.)

Hall; mount, west of Upper Arrow lake, Kootenay district, B.C.

Hall; mount, north of Chemainus river, Vancouver island, B.C. (Not Hall's.)

Hall; peninsula, in the southeastern portion of Baffin island, N.W.T.

Hallett; lake, on trail between Cheslatta and Fraser lakes, Coast district, B.C.

Halliday. See Holliday.

Hall's. See Kushog.

Halsey; point, at the entrance to Douglas channel, Coast district, B.C.

Halsted; islet, Shushartie bay, Goletas channel, northerly coast Vancouver I., B.C.

Hambly; island, Navy group, St. Lawrence river, Leeds county, Ont. (Not Humbly.)

Hamilton; island, in Ottawa river, Prescott county, Ont. (Not Great nor Large.)

Hamilton; lake, Tp. 35, Rs. 9 and 10, W. 4 M., southeastern Alberta.

Hammond; bay, north of Departure bay, southeast coast of Vancouver I., B.C.

Hammond; point, east of Jenkins point, Manitoulin island, Manitoulin district, Ont.

Hammond. See Nelson.

Hanalta; lake, Tp. 31, R. 14, W. 4 M., Alberta. (Not Bullpound.)

Hanbury; peak, east of mount Vaux, Rocky mountains, Kootenay district, B.C.

Hanceville; post settlement, on Chilcotin river, Lillooet district, B.C.

Hancock; hills, east of lake Laberge, Yukon.

Hand; hills, east of Red Deer river, southern Alberta.

Hanging Hide See Leather.

Hanna; bank, S. of Dokis I., entrance Key harbour, Parry Sound district, Ont.

Hannah; bay, south end of James bay, Timiskaming district, Ont.

Hannah Bay (river). See Harricanaw.

Hannah; lake, east of South bay, lake Nipigon, Thunder Bay district, Ont.

Hannah; point, South bay, Manitoulin district, Ont.

Hansen; lake, east of Kootenay river, north of Steele, Kootenay district, B.C.

Harbour; lake, west of Blind bay, Halifax county, N.S. (Not Black Duck Run.)

Harbour. See Rawson.

Harbour au Bouche. See Havre Bouché.

Harbour de Lute. See Loutre.

Hardisty; mount, east of Athabaska river, opposite mouth of Whirlpool river, Alta.

Hardwood Plains. See Harwood Plains.

Hardy; mountain, northwest of Carson, Similkameen district, B.C.

Hare; bank, island, passage, and reefs, St. Lawrence river, Temiscouata county, Que. French usage: Lièvres (île aux), which see.

Harmer; creek, tributary to Grave creek, Kootenay district, B.C. (Not south fork of Grave creek.)

Harmony; river, emptying into Harmony bay, east end of L. Superior, Algoma district, Ont. (Not Chippewa nor Harmonie.)

Harmony. See Jones.

Harold; mount, on lower part of Stikine river, Cassiar district, B.C.

Harper; mount, in the Ogilvie range, north of Klondike river, Yukon.

Harper Corners; post office, Wentworth county, Ont. (Not Harper's Corners.)

Harricanaw; river, emptying into Hannah bay, Timiskaming, Ont., from Abitibi and Timiskaming, Que. (Not Hannah Bay river.)

Harrington; group of islands, north shore gulf of St. Lawrence, St. Vincent township, Saguenay county, Que.

Harrington; post office, Oxford county, Ont. (Not Harrington West.)

Harrington West. See Harrington.

Harris; creek, branch of Ophir creek, Indian river, Yukon.

Harris; lake, southwest of Manitou lake, Kenora district, Ont.

Harris; lake, southwest of Savant lake, Thunder Bay district, Ont.

Harris; point, Lambton county, Ont. (Not Blue.)

Harrison; post office, Stormont county, Ont. (Not Harrison's Corners.)

Harrison; river, flowing northwesterly into Athabaska lake, near Stone point, Alta.

Harrison Corners. (See Harrison.)

Harry; lake, Lawrence township, Haliburton county, Ont. (Not Harry's.)

Hart; mount, near Sixtymile river, southwesterly from Dawson, Yukon.

Hartz; creek, tributary to Tahltan river, Cassiar district, B.C.

Harvey; creek, tributary to Flathead river, Kootenay district, B.C. (Not Twenty-five Mile creek.)

Harvey; island, Brock group, St. Lawrence river, Leeds county, Ont. (Not Gibraltar.)

Harwood Plains; post office, Carleton county, Ont. (Not Hardwood Plains.)

Haskins; creek, tributary to Ottertail river, Rocky mountains, Kootenay district, B.C. (Not Haskin.)

Haslam; creek, tributary to Nanaimo river, Vancouver island, B.C.

Häsler; a peak of mount Dawson, Selkirk mountains, Kootenay district, B.C.

Hastings; county, also town in Northumberland county, Ont.

Hastings; lake, in Tp. 51, R. 20, W. 4th M., Alberta.

Hatchau; lake, Hackett river, Cassiar district, B.C. (Not Macha.)

Hatin; lake, near upper part of Koshin river, Cassiar district, B.C.

Hatton; headland, at south end of Resolution island, N.W.T. (Not Cape Best.)

Haven; cape, Clements Land, N.W.T. (Not Siggia.)

Haven; creek, flowing into the Saskatchewan, below Bighorn river, central Alberta.

Havre Bouché; harbour and post village, near northwest entrance to the strait of Canso, Antigonish county, N.S. (Not harbour au Bouche nor Havre Boucher.)

Hawk; lake, also Hawk Lake railway station, Kenora district, Ont.

Hawkcliff; lake, west of Eagle lake, Kenora district, Ont. (Not Hawk Cliff.)

Hawkesbury; island, north of Princess Royal and Gribbell islands, Coast district, B.C.

Hawkins; creek, tributary to Moyie river, international boundary, Kootenay district, B.C. (Not Meadow nor Ripple.)

Hawkrock. See Keikewabik

Hawtrey; town, Oxford county, Ont. (Not Hawtry.)

Hay; lake, Sabine township, Nipissing district, Ont.

Hay. See Dobbs.

Hay. See Melville.

Hayes; mount, south of Haslam creek Vancouver island, B.C.

Hayes; peak and river, west of Teslin lake, Cassiar district, B.C.

Hayes; river, southeast of Nelson R., Manitoba. (Not Hay's, Hill, Steel, nor Trout.) This name is now applied to the whole river from the source of the Echimamish to Hudson bay.

Haygarth; creek, tributary to Ottertail river, Yoho park, Rocky mountains, B.C.

Hays; cove, southwest of Ritchie point, Kaien island, Coast district, B.C.

Hays; creek, Prince Rupert, Coast district, B.C.

Hays; mount, on Kaien island, east of Prince Rupert harbour, Coast district, B.C. (Not Oldfield.) Previous decision revised.

Hay's. See Hayes.

Hays. See Ritchie.

Haystack; mountain, N.E. of Windigo bay, L. Nipigon, Thunder Bay district, Ont.

Hazel. See Aberdeen.

Hazelton; town, at confluence of Bulkley and Skeena rivers, Cassiar district, B.C.

Head; mount, Highwood range, southern Alberta.

Headingley; parish and post village, Man. (Not Headingly.)

Head of Jordan River. See Jordan river.

Head of St. Peter's Bay. See St. Peter.

Healy; lake, south of Kusawa lake, Yukon.

Heart; creek, east of Lower Arrow lake, Kootenay district, B.C.

Heart; lake, east of L. LaBiche, central Alberta.

Heart; mountains, east of Sheslay river, Cassiar district, B.C.

Heathcote; lake, northwest of Barrington lake, Thunder Bay district, Ont.

Hebden; brook, flowing into Dinorwic lake, Kenora district, Ont. (Not Hebden's.)

Hébécourt; lake, Hébécourt township, Timiskaming county, Que.

Hébert; lake, Dufay township, Timiskaming county, Que. (Not Fish.)

Hebert. See Bear.

Hecate; channel, connecting Esperanza inlet with Tahsis canal, Vancouver I., B.C.

Hecate; strait, between Queen Charlotte islands and the mainland, Coast district, B.C.

Hecate. See Raymond.

Hecla; island, in lake Winnipeg, Man. (Not Big, Big Black, nor Great Black.)

Hector; island, north shore of Hudson strait, N.W.T. (Not Khartum.)

Hector; lake, west of Manitou lake, Kenora district, Ont. (Not Large Trout.)

Hector; mount, also lake, southern Alberta. (Not Bow lake nor Lower Bow lake.)

Hector; railway station, Kootenay district, B.C.

Height-of-land; lake, northeast of Mattagami lake, Abitibi territory, Que.

Heimdal; a spur of the Valhalla mountains, Kootenay district, B.C.

Hela; a peak of the Valhalla mountains, Kootenay district, B.C.

Helen; lake, at headwaters of Bow river, Alberta.

Helen; lake, north of Nipigon, Thunder Bay district, Ont.

Helen; point, Douglas channel, near Kitkiata, Coast district, B.C.

Helena. See Kinney.

Helmet; mountain, southeast of mount Goodsir, Rocky Mts., Kootenay district, B.C.

Hemlock. See Mackay.

Hen. See North Fowl.

Henderson; creek, tributary to Yukon river, below Stewart river, Yukon.

Henderson; harbour, south of Crooks inlet, Hudson strait, N.W.T.

Henderson; lake, north of Uchucklesit harbour, Barkley sound, Vancouver island, B.C. (Not Anderson.)

Hendon; river, tributary to Kusawa river, Cassiar district ,B.C. and Yukon.

Hennigar; brook and post village, Hants county, N.S. (Not Weir or Hennigar brook, Joshua Hennigar brook, nor Northfield village.)

Henning; mount, at headwaters of Coquihalla river, Yale district, B.C.

Henrietta; creek, tributary to Last-chance creek, a branch of Hunker creek, Yukon.

Henry Corners; village, Lambton county, Ont. (Not Henry's Corners.)

Henry; island, southwest of Port Hood, Inverness county, N.S. (Not Outer island, Outer island of Port Hood, nor W. D. Smith's island.)

Henry; point, Pittsburgh township, Frontenac county, Ont.

Hensley; bay, south shore of Manitoulin island, Manitoulin district, Ont.

Herb. See Wekusko.

Herbert Corners; post office, Carleton county, Ont. (Not Herbert's Corners.)

Hermit; glacier, mountain, and range of mountains, in the Selkirks, B.C.

Heron. See Mirond.

Herschell; island, W. of Cockburn I. and N.E. of Kitchener I., Manitoulin dis., Ont.

Hess; river, tributary to Stewart river, Yukon.

Hester; creek, branch of Hunker creek, Yukon.

Hewson. See Hughson.

Hibben; island, between Inskip and Moore channels, Moresby island, Queen Charlotte group, Coast district, B.C. (Not Kuper.)

Hiboux. See Ciboux.

Hickey; island, between Collier and Stave islands, Navy group, St. Lawrence river, Leeds county, Ont. (Not Smoke.)

Hickory. See Francis.

Hidden. See Habel.

High. See Emma.

High. See Highwood.

High Bluff; parish and village, on Assiniboine river, Manitoba.

High Fall; creek, tributary to Koksoak river, New Quebec.

Highpound. See Buffalo Pound.

Highstone; lake, north of Stranger lake, Kenora district, Ont.

Highview; post office, south of Broadview, Sask. (Not High View.)

High Water. See Piché.

Highwood; range of mountains, southern Alberta.

Highwood; river, tributary to Bow river, Alberta. (Not High.)

Hilda; a peak of the Valkyr mountains, Kootenay district, B.C.

Hill; cove, northeast of Prince Rupert, Coast district, B.C.

Hill; island, S.W. of Rockport, St. Lawrence R., Leeds county, Ont. (Not Leroux.)

Hill; island, at entrance to Russell arm, Prince Rupert harbour, Coast district, B.C.

Hill; lake, northeast of Kakagi lake, Kenora district, Ont.

Hill; lake, on Minago river, Manitoba.

Hill. See Hayes.

Hillfarm; post office, north of Wolseley, Sask. (Not Hill Farm.)

Hillhead; village, Argenteuil county, Que. (Not Hill Head.)

Hilton; village, St. Joseph island, Algoma district, Ont. (Not Marksville.)

Hinchinbrook; township, Huntingdon county, Que. (Not Hinchinbrooke.)

Hinckley. See Carpenter.

Hinton; mount, Gustavus group, Yukon.

Hippa; island, W. of Graham I., Queen Charlotte Is., Coast dist., B.C. (Not Nesto.)

Hitchcock; creek, flowing east into Teslin lake, Cassiar district, B.C.

Hobson; island, in Mahone bay, Lunenburg county, N.S. (Not Hobson's Nose.)

Hockstall. See Ecstall.

Hoder; creek, tributary to Little Slocan river, Kootenay district, B.C.

Hodgins, lake, south of L. Seul, Kenora district, Ont.

Hodnett; mount, northwest of the "big bend" of Wheaton river, southern Yukon.

Hoffman; mount, on south branch of Sheep river, southern Alberta.

Hog. See Camelot.

Hog. See McDonald.

Hog. See O'Neil.

Hogarth. See Cumberland

Hogg; creek, tributary to Moyie river, Kootenay district, B.C.

Hoggan; lake, near Dodd narrows, east coast of Vancouver island, B.C.

Holden; lake, east of Nanaimo river, Vancouver island, B.C. (Not Trois Bras.)

Hole. See Wanipigow.

Holland; bank, Ladysmith harbour, east coast of Vancouver island, B.C.

Holland. See Cascumpeque.

Holliday; point, Wolfe island, Frontenac county, Ont. (Not Halliday nor Levi.)

Holmes. See Home.

Holway; mount, southwest of Sorcerer mountain, Selkirk Mts., Kootenay dist., B.C.

Homalko. See Homathko.

Homan; river, discharging into Bennett lake, Cassiar district, B.C.

Homathko; river, flowing into Bute inlet, Coast district, B.C. (Not Homalko.)

Home; bay, in N. end of Princess Royal I., Coast district, B.C. (Not Holmes.)

Home; island, Coronation gulf, N.W.T. (Not Sir E. Home's.)

Hoodoo; valley, near Leanchoil, Kootenay district, B.C.

Hooker; pass, at the head of St. Mary river, Kootenay district, B.C.

Hoole; canyon and river, upper part of Pelly river, Yukon.

Hooper; island, off the southeast side of Grenadier island, St. Lawrence river, Leeds county, Ont. (Not Hooper's.)

Hoople; creek, flowing into the St. Lawrence, at Dickinson Landing, Stormont county, Ont. (Not Hoople's, Hoopole, nor Hoopple.)

Hootalinqua. See Teslin.

Hopes Advance; bay, west coast of Ungava bay, New Quebec.

Hopes Advance; cape, south shore of Hudson strait, New Quebec. (Not Cape of Hopes Advance nor Prince Henry Foreland.)

Hopewell Corner. See Albert.

Hopkins; bay and point, east of Baptist island, Bruce county, Ont.

Hopkins; lake, southeast of Aishihik lake, Yukon.

Hopkins; point, Devastation channel, Coast district, B.C.

Horn; cape, on the east side of Upper Arrow lake, Kootenay district, B.C.

Horn. See Beatrice.

Horse; creek, tributary to Bow river, Alberta.

Horse; point, in eastern part of Ameliasburg township, Prince Edward county, Ont.

Horsehead; creek, flowing northerly to Makwa R., central Sask. (Not Horse Head.)

Horseshoe; bay, west side of Great Duck island, Manitoulin district, Ont.

Horseshoe; glacier, south of mount Lefroy, Alberta.

Horseshoe; island, west of Wolf island, Frontenac county, Ont. (Not Horse Shoe.)

Horse Shoe. See Chemainus.

Horsfall; island, between Campbell and Dufferin islands, Coast district, B.C.

Horswell; bluff and channel, S.E. coast of Vancouver I., B.C. (Not Inner channel.)

Horton; creek, tributary to Pelly river, between Hoole and Ketza rivers, Yukon.

Horton; point, north of Kincardine, Bruce county, Ont.

Hosier; river, flowing into St. Margaret bay, Halifax county, N.S. (Not Osier.)

Hosmer; mountain ridge, between Elk river and Michel creek, east of Hosmer, Kootenay district, B.C.

Hospital; creek, flowing into Columbia river, below Golden, Kootenay district, B.C.

Hotailuh; mountains, between Stikine and Tanzilla rivers, Cassiar district, B.C.

Houghton; lake, southwest of Kashaweogama lake, Thunder Bay district, Ont.

Houghton; lake, in Tps. 39 and 40, R. 22, W. 2 M., Sask. (Not Dirtywater.)

Houghton. See Muskiki.

Hourglass; lake, west of Hodgins lake, Kenora district, Ont.

House; mountain, between Driftpile and Inverness rivers, S. of Lesser Slave L., Alta.

House. See Howse.

Housten. See Hughson.

Houston. See Houstoun.

Houstoun; passage, betweeen Admiral, Kuper and Narrow islands, strait of Georgia, New Westminster district, B.C. (Not Houston.)

Howe; island, St. Lawrence river, Frontenac county, Ont.

Howe. See Fuller.

Howell; creek, tributary to Flathead river, Kootenay district, B.C.

Howse; pass and peak, Rocky mountains, Alta. and B.C. (Not House.)

Howser. See Duncan.

Hozameen; range of mountains, east of Skagit river, near international boundary, Yale district, B.C. (Not Hozamen, Hozomen nor Hozomeen.)

Hubbards; village, Halifax Co., N.S. (Not Hubbards Cove.) Previous decision revised.

Huber; mount, near mount Victoria, Rocky mountains, Kootenay district, B.C.

Hubert; railway station, north shore of Skeena river, Coast district, B.C.

Hubley; cove, St. Margaret bay, also lake and Ry. sta., Halifax Co., N.S. (Not Hubly.)

Hubly. See Hubley.

Huckleberry. See Mile.

Huckstall. See Ecstall.

Hudson; bay, Ontario, Quebec, Manitoba, and N.W.T. (Not Hudson's.)

Hudson Bay; mountains, west of Bulkley river, and south of Moricetown, Coast district, B.C.

Hudson; island, south of Thetis island, Stuart channel, S.E. coast of Vancouver I., B.C.

Hudson; strait, between Baffin island, N.W.T. and New Quebec.

Huff; island, in Muscote bay, bay of Quinte, Prince Edward Co., Ont. (Not Huff's.)

Hugh; mount, east of lake Evans, Abitibi territory, Que.

Hughes; brook, Barritt bay, Wabigoon L., Kenora district, Ont. (Not Hughes creek.)

Hughes; range of mountains, east of Kootenay river, Kootenay district, B.C.

Hughson; bay, east of Providence bay, Manitoulin island, Manitoulin district, Ont. (Not Hewson, Housten, nor Husten.)

Humber; bay, railway station, river, and village, also Humber Bay post office and summer resort, York county, Ont. (Not Clairville village.)

Humbly. See Hambly.

Humboldt; bay, east shore of lake Nipigon, Thunder Bay district, Ont.

Humboldt; electoral district, post office, and railway station, Sask. (Not Humbolt.)

Hungabee; glacier and mountain, Bow range, Alta. and Kootenay district, B.C.

Hungerford; point, on the southern portion of Manitoulin island, Ont.

Hungry; bay, northeast side of Big bay, bay of Quinte, Ont.

Hungry; peak, at head of St. Mary river, Kootenay district, B.C.

Hunker; creek, tributary to Klondike river, Yukon.

Huns Valley; village, Macdonald electoral district, Man. (Not Hun's Valley.)

Hunter; island, near Int. bdy., Rainy R. district, Ont. (Not Hunter's nor Hunters.)

Hunter; mount, north of Palliser station, Kootenay district, B.C.

Hunters; range of mountains, south of Eagle river, Kamloops district, B.C.

Huntingdon; post settlement, international boundary, New Westminster district, B.C.

Huntress; reef, southwest of Johnston point, Bruce county, Ont.

Hurd; cape, west extreme of Bruce Co., Ont. Cape Hurd channel is west of the cape.

Hurd; mount, also pass, in the Ottertail range of the Rockies, Kootenay district, B.C.

Hurdman; post office, Carleton county, Ont. (Not Hurdman's Bridge.)

Hurdman's Bridge. See Hurdman.

Huron; river, flowing into Chambly basin, Richelieu river, Rouville county, Que. (Not Marieville creek.) Authorized French form: rivières des Hurons.

Hurricane; river, tributary to Nakina river, Cassiar district, B.C.

Husten. See Hughson.

Hutchison; creek, flowing from Bowden lake to Wabigoon river, Kenora district, Ont.

Hutchison; creek, flowing into east side of Lower Arrow lake, Kootenay district, B.C.

Hutchison. See Hutchinson.

Hutshi; lakes, west of lake Laberge, Yukon.

Hutshiku; bluff, on Lewes river, below Rink rapid, Yukon.

Hutsigola; lake, south of Teslin lake, Cassiar district, B.C. (Not Hutsigula.)

Huxstall. See Ecstall

Hyland; hill, east of Hutsigola lake, Cassiar district, B.C.

Hyndman; bay, at southwest end of Cockburn island, Manitoulin district, Ont. (Not Sand.)

I

Icarus; point, Nanoose harbour, east coast of Vancouver island, B.C.

Ice; portage, on the lower part of Nottaway river, below Kitchigama river, Abitibi, Q.

Ice; river, tributary to Beaverfoot river, Kootenay district, B.C.

Ice-cap; mountain, near lower Stikine river, Cassiar district, B.C. (Not Ice-capped.)

Icelandic; river, emptying into lake Winnipeg, Man. (Not Icelanders.)

Ichimanicuagon. See Ishimanikuagan.

Iconoclast; mountain, Selkirk range; Kootenay district, B.C.

Icy; cove, east of North bay, Hudson strait, N.W.T.

Ida; mount, south of Salmon arm of Shuswap lake, Kamloops district, B.C.

Ikeda; bay, southeast of Skincuttle inlet entrance, southeast coast of Moresby island, Queen Charlotte group, Coast district, B.C.

Ile aux Morts. See Lark.

Ile-aux-Noix; post office, St. John county, Que. (Not Isle aux Noix.)

Ile-Bizard; post office, on island of same name, St. Lawrence river, Jacques Cartier county, Que. (Not Isle Bizard.)

Ile-Perrot; post office, Vaudreuil county, Que. (Not Isle Perrot.)

Illecillewaet; glacier, mining division, river, and town, Kootenay district, B.C. (Not Illecilliwaet, Illicillewaet, nor Illicilliwaet.)

Illes; brook, emptying into Frances lake, Yukon. (Not Il-es-too-a.)

Impérieuse; rock, Nanoose harbour, east coast of Vancouver island, B.C.

Incomappleux; river, flowing into Upper Arrow L., Kootenay dist., B.C. (Not Fish.)

Independence; creek, tributary to Stewart river, Yukon.

Indian; brook, flowing into St. Ann bay, Victoria county, N.S.

Indian; harbour, point, and reef, south of Fitzwilliam island, Manitoulin district, Ont.

Indian; island, northeast of Murray canal entrance to the bay of Quinte, Prince Edward county, Ont.

Indian; river, tributary to Yukon river, south of Klondike river, Yukon.

Indian. See Dares.

Indian. See Longspell.

Indian. See Pleasant.

Indian. See Southern Indian.

Indian Pear Island lake. See Saskeram.

Ingall; island, S. of Whitney Pt., St. Lawrence R., Leeds Co., Ont. (Not Shoemaker.)

Ingall; lake, southwest of Wabigoon lake, Kenora district, B.C.

Inganish. See Ingonish.

Ingersoll; mount, west of Columbia river, Kootenay district, B.C.

Inglewood; post office and railway station, Peel county, Ont. (Not Inglewood Junction.)

Inglismaldie; mount, south of Minnewanka lake, Rocky mountains, Alberta.

Ingonish; bay, river, and town, Victoria county, N.S. (Not Inganish nor Niganishe.)

Ingraham. See Louis.

Ingram; mount, north of Kusawa lake, Yukon.

Inhabitants; river, Richmond county, N.S. (Not Habitants.)

Inklin; river, tributary to Taku river, Cassiar district, B.C.

Inkster; rock, at South Baymouth, Manitoulin island, Manitoulin district, Ont.

Inlin; brook, tributary to lower Gravel river, N.W.T.

Innarulligang. See East Bluff.

Inner. See Horswell.

Inner Duck; island, northeastern island of Duck I. group, Manitoulin district, Ont.

Inonoaklin; creek, west of Lower Arrow L., Kootenay district, B.C. (Not Sanderson.)

Insulated. See Isolated.

Inukshiligaluk; point, south coast Ungava bay, New Quebec. (Not Big Rock.)

Inukshuktuyuk; point, south coast of Ungava bay, New Quebec. (Not Beacon.)

Inverhuron; bay and village, Bruce county, Ont.

Invermere; townsite, south of Windermere, Kootenay district, B.C. (Not Canterbury.)

Inverness; passage, between Porpoise harbour and Skeena R., B.C. (Not N. Skeena.)

Inverness; river, tributary to Swan river, south of Lesser Slave lake, central Alberta.

Iosegun; lake and river, tributary to Little Smoky river, Alta. (Not Attim Segoun nor Io-se-gun.)

Ipperwash. See Kettle.

Ireland; township, Megantic county, Quebec.

Irishman; creek, tributary to Moyie river, Kootenay district, B.C.

Iron; creek, tributary to Battle river, eastern Alberta.

Iron;creek, tributary to Bull river, Kootenay district, B.C.

Iron; lake, west of Crooked lake, international boundary, Rainy river district, Ont.

Iroquois; lake, Tp. 48, Rs. 7 and 8, W. 3 M., Sask.

Irving; bay, Crooks inlet, Hudson strait, N.W.T.

Irving; post settlement, Albert county, N.B. (Not Baltimore.)

Isaac Harbour; town, Guysborough county, N.S. (Not Isaac's Harbour.)

Isabella; lake, northeast of Peyto lake, Alberta.

Isabemagussi. See Magusi.

Iserhoff: river, emptying into Waswanipi lake, Abitibi territory, Que.

Ishimanikuagan; lake, Saguenay Co. ,Q. (Not Ichimanicuagan nor Ishimanicougan.)

Iskut. See Kinaskan.

Iskwatikan; lake, north of lake LaRonge, central Saskatchewan.

Island; lake, northeast of L. Winnipeg, and draining into Hayes river, Manitoba.

Island. See Ashby.

Island. See Dasserat.

Island. See Trade.

Island lake. See Isle lake.

Island Portage (lake). See Pine.

Islands; lake of, southeast of Abitibi lake, Timiskaming county, Que.

Isle; lake, west of St. Ann, Alberta. (Not Island lake.)

Isle Bizard. See Ile-Bizard.

Isle de Bois. See Morris.

Isle of coves. See Cove.

Isles aux Pêches. See Peach island.

Islet; point, southwesterly extremity of Sonora island, Coast district, B.C.

Isnor. See Eisner.

Isolated; peak, at head of Yoho valley, Rocky mountains, Kootenay district, B.C. (Not Insulated nor Lonely.)

Ithenotosquan. See Elbow.

Itsi; lakes, on Ross river, also mountains between Macmillan and Ross rivers, Yukon.

Ittimenotok; cape, east shore of Ungava bay, New Quebec.

Ivan; point, Manitoulin island, east of Burnt island, Manitoulin district, Ont.

J

Jack; lake, Burleigh township, Peterborough county, Ont. (Not Jack's.)

Jack; point, S. entrance to Nanaimo, Vancouver I., B.C. (Not Jack's nor Sharp.)

Jackhead; island, lake, and river, north of Fisher bay, lake Winnipeg, Man. (Not Jack-Head.)

Jackman. See Pritzler.

Jackson; creek, tributary to Souris river, southern Manitoba and Saskatchewan.

Jackson; mount, south of Tulameen, Yale district, B.C.

Jackson. See Robertson.

Jackstraw; island, west of Gordon island, St. Lawrence river, Leeds county, Ont.

Jackstraw; lighthouse and shoal, St. Lawrence river, west of Gananoque, Leeds county, Ont. (Not Jack Straw.)

Jacob; creek, tributary to Bow river, Alberta.

Jacob; island, at entrance to Rupert bay, James bay, Que. (Not Wood.)

Jacob; lake, Caire township, Timiskaming county, Que. (Not Fish.)

Jacques-Cartier; lake and river, Montmorency county, Que. (Not Grand Lake Jacques Cartier.)

James; cape, north shore of Hudson strait, N.W.T.

James; island and reef, between Fitzwilliam and Yeo islands, Georgian bay, Manitoulin district, Ont.

James; river, tributary to Red Deer river, southern Alberta.

James Ross. See Ross.

Jamieson; lake, Dungannon township, Hastings county, Ont. (Not Jamieson's).

Jamieson's. See Egan.

Janet; lake, between Stewart river and Mayo brook, Yukon.

Jansen; lake and post office, west of the Quill lakes, southern Saskatchewan.

Janvrin; island, and Janvrin Harbour P.O., Richmond Co., N.S. (Not Jauvrin's.)

Jareux. See Jureux.

Jarvis; bay, island, point, river, and rock, Thunder Bay dist., Ont. (Not Turtle Pt.)

Jarvis; lake, between Athabaska and Baptiste rivers, Alta. (Not Upper White Fish.)

Jauvrin's. See Janvrin.

Jay, lake, Pettypiece township, Kenora district, Ont.

Jean; lake, southeast of lake Nipigon, Thunder Bay district, Ont.

Jean de Terre. See Gens-de-Terre.

Jeannette; creek, post office, and railway station, Kent county, Ont. (Not Jeannette's creek nor Jeannette's Creek P.O.)

Jean-Noël; river, flowing into the St. Lawrence, at St. Irénée, Charlevoix Co., Q.

Jean-Pierre; bay and point, southwest of Sturgeon bay, north shore of L. Superior, Thunder Bay district, Ont.

Jeffrey; mount, west of Saanich inlet, Vancouver island, B.C.

Jenkins; point, east of Providence bay, Manitoulin island, Manitoulin district, Ont.

Jennie Graham; the most southerly shoal off Great Duck I., Manitoulin district, Ont.

Jennings; river, emptying into Teslin lake, Cassiar district, B.C. (Not Fifteenmile.)

Jensen; creek, tributary to Dominion creek, Indian river, Yukon.

Jesse; island, entrance to Departure bay, southeast coast of Vancouver island, B.C.

Jessie; lake, Purdom township, Thunder Bay district, Ont.

Jesup Land. See Ellesmere.

Jim; creek, tributary to Yukon river, below Indian river, Yukon.

Joan; point, near Dodd narrows, east coast of Vancouver island, B.C.

Joassa; channel, between Dufferin and Horsfall islands, Coast district, B.C.

Jocelyn; hill, east side of Finlayson arm, Vancouver island, B.C.

Jockvale; post office, Carleton county, Ont. (Not Jock Vale.)

Joel; river, tributary to Klondike river, Yukon.

Joggins; village, Cumberland county, N.S. (Not Joggin Mines, South Joggins, nor South Joggings.)

John; lake, northeast of Silver lake, Kenora district, Ont.

John; lake, below Itsi lakes, Ross river, Yukon.

John; river, also River John post office, Pictou county, N.S.

Johnny. See Johnson.

Johnson; bay, north shore of Howe island, Frontenac Co., Ont. (Not Johnston.)

Johnson; lake, Havelock township, Haliburton county, Ont. (Not Johnson's.)

Johnson; lake and railway station, southeast of Latchford, Timiskaming district, Ont. (Not Johnny lake nor Johnston station.)

Johnson; range of mountains, between Atlin L. and O'Donnel R., Cassiar district, B.C.

Johnston Corners; post office, Carleton county, Ont. (Not Johnston's Corners nor Johnstone's Corners.)

Johnston; creek, tributary to McQuesten river, Yukon.

Johnston; creek, west of Lower Arrow lake, Kootenay district, B.C.

Johnston; harbour and point, southeast of Porcupine point, Bruce county, Ont.

Johnston; lake, southern Saskatchewan.

Jojo; lake, north of lake Nipigon, Thunder Bay district, Ont.

Jolicœur; village, Westmorland county, N.B. (Not Jolicure.)

Joli Head; headland, Queens county, N.S. (Not Jolie Head.)

Jonas; creek, flowing northwesterly into Sunwapta river, also pass at the head of the creek, western Alberta.

Jones; creek, flowing to Batchawana bay, L. Superior, Ont. (Not Harmony river.)

Jones; island, Lake Fleet group, St. Lawrence river, Leeds county, Ont.

Jones; shoal, S. of Labrador reef and S.W. from Belanger point, Manitoulin dist., Ont.

Jonquière; railway station, township, and village, Chicoutimi county, Que. (Not Jonquières.)

Jordan Harbour; post office, Lincoln county, Ont. (Not Jordan Harbor.)

Jordan; lake and river, Hastings county, Ont.

Jordan; river, flowing into Frobisher bay, N.W.T.

Jordan; river, tributary to Columbia river, near Revelstoke, Kootenay district, B.C.

Jordan; river, flowing into Juan de Fuca strait, Vancouver island, B.C.

Jordan River; village, Shelburne county, N.S. (Not Head of Jordan River.)

Jorkins; point, southeast entrance to Finlayson channel, B.C. (Not Dawkins.)

Joseph; creek, tributary to St. Mary river, Kootenay district, B.C.

Joshua Hennigar. See Hennigar.

Joss; mountain, northeast of Mabel lake, Kamloops district, B.C.

Joubert; island, south of Cascade point, Soulanges county, Que. (Not Round.)

Joy. bay, south shore of Hudson strait, New Quebec.

Joy; mountain, between Hess and Lansing rivers, Yukon.

Jubilee; island, north shore of Hudson strait, N.W.T.

Jubilee; mountain, near north end of Atlin lake, Yukon.

Julian; point, east of Chorbak inlet, north shore of Hudson strait, N.W.T.

Julien; islet, on Kamouraska mud flats, Kamouraska county, Que.

Jumping; lake, east of the Birch hills, central Saskatchewan.

Jumping Deer; creek, tributary to Qu'Appelle river, Sask. (Not Jumpingdeer.)

Jumpingpound; creek, tributary to Bow river, Alberta. (Not Jumping Pond.)

Junction; mountain, on south branch of Sheep river, southern Alberta.

Junnusuksoak; inlet, east shore of Ungava bay, New Quebec.

Juno; point, south of Pine Tree harbour, Bruce county, Ont.

Jupiter; river, south side of Anticosti I., Saguenay county, Que. (Not Observation.)

Jupiter. See Shallop.

Jureux; point, also river flowing into the St. Lawrence below Goose cape, Charlevoix county, Que. (Not Jareux.)

K

Kabagukski; lake, south of Sasakwei lake, Kenora district, Ont. (Not Mud.)

Kabakwa; lake, Stanhope township, Haliburton Co., Ont. (Not Kah-bah-bah-quah.)

Kabania; lake, west of Attawapiskat lake, Patricia district, Ont.

Kabikwabik; lake, south of Minnitaki lake, Kenora district, Ont. (Not Kapikwabikok.)

Kabistachuan; bay, in southern portion of Mistassini lake, Q. (Not Cabistachuan.)

Kabitotikwia; lake and river, draining into Kaiashk bay, L. Nipigon, Thunder Bay district, Ont. (Not Kabitotiquia.)

Kabitotiquia. See Kabitotikwia.

Kabitustigweiak. See Butler.

Kabona; lake, south of Matchimanito lake, Pontiac county, Que.

Kagianagami; lake, north of Ogoki river, Thunder Bay district, Ont.

Kag-ish-a-bog-a-mog. See Kasshabog.

Kagiwiosa. lake, east of Dinorwic lake, Kenora district, Ont.

Kaha; creek, tributary to Koshin river, Cassiar district, B.C. (Not Kahak.)

Kah-bah-bah-quah. See Kabakwa.

Kah-mini-ti-gwa-quiack. See Bluffy.

Kah-shah-gah-wig-e-mog. See Kashagawi.

Kahtate; river, tributary to lower part of Stikine river, Cassiar district, B.C.

Kahuch. See Katonche.

Kah-wah-she-be-mah-gog. See Kushog.

Kahwambejewagamog. See Kawagama.

Kaiashk; bay and river, W. shore of L. Nipigon, Thunder Bay dist., Ont. (Not Gull.)

Kaiashkomin; lake, north of Wabigoon lake, Kenora district, Ont. (Not Bad Rice.)

Kaien; island, Prince Rupert harbour, Coast district, B.C. (Not Kai-en.)

Kaiete; point, at east entrance to Lama passage, Coast district, B.C. (Not Calete, Ki-ette, nor Kyeet.)

Kaijick Manitou. See Baptiste.

Kaikaquabick. See Reception.

Kains. See Cain.

Kaishk. See Evain.

Ka-its-siks. See Kasiks.

Kajakanikamak. See Dufresnoy.

Kajoualwang. See Najwalwank.

Kakabonga; lake and river, east of Grand lake Victoria, Pontiac county, Que. (Not Kakebonka.)

Kakagi; lake, E. of Sabaskong bay, L. of the Woods, Kenora dist., Ont. (Not Crow.)

Kakameonan. See Bellefeuille.

Kakashe; river, tributary to Kapitachuan river, Montcalm county, Que.

Kakebonka. See Kakabonga.

Kaketsa; mountain, south of Egnell, Cassiar district, B.C. (Not Koketsa.)

Kakinagimak; lake, south of Churchill river and east of Pelican narrows, Sask. (Not Kakinokumak.)

Kakinnozhans; lake, near Manitou lake, Kenora district, Ont.

Kakinokamak. See Lemoine.

Kakinokumak. See Kakinagimak.

Kakinookama. See Margaret.

Kakisksagamak. See Ventadour.

Ka-koot. See Kakut.

Kakuchuya; river, tributary to Dudidontu river, Cassiar district, B.C.

Kakut; lake and river, in the Birch hills, south of Dunvegan, Alta. (Not Ka-koot.)

Ka-lik-took-duag. See Crooks.

Kalzas; lake, between Macmillan and Stewart rivers, Yukon.

Kama; bay and Ry. station, Nipigon bay, Thunder Bay dist., Ont. (Not Mazokama.)

Kamachigama; lake. and river tributary to the Upper Ottawa, Montcalm county, Que.

Kamamintigongue. See Lescarbot.

Kamanatogama; lake, southeast of Boyer lake, Kenora district, Ont.

Kamaniskeg; lake, Bangor township, Hastings county, Ont.

Kamatsi; lake, on Churchill river, east of Reindeer river, central Saskatchewan.

Kamililamac. See Biart.

Kaministikwia; river and railway station, Thunder Bay district, Ont. (Not Kaministiquia.)

Kaminnassin; lake, south of Dinorwic lake, Kenora district, Ont.

Kaminnaweiskagwok. See Minnaweiskag.

Kaminni; lake, N.W. of Manitou lake, Kenora district, Ont. (Not Kaminneseipekok.)

Kamitsgamak; lake, on Ribbon river, upper St. Maurice river, Champlain county, Que.

Kamongus; lake, near Manitou lake, Kenora district, Ont. (Not Canoe.)

Kamoukakwiti. See Piché.

Kamouraska; bay, county, group of islands, river, and village, Que.

Kampigukakatoka; river, tributary to Migiskan river, Pontiac county, Que.

Kamshigama; lake and river, north of Shabogama lake, Abitibi territory, Que.

Kananaskis; lakes and river, tributary to Bow river, post office, railway station, and range of mountains, Alta., also pass, Alta and B.C.

Kanasuta; river, flowing from Dasserat lake to Duparquet lake, Timiskaming, Que

Kangerflung. See Newell.

Kangerthialuksoak. See George..

Kaniapiskau; river, tributary to Koksoak river, New Quebec. (Not Wauguash.)

Kaniapiskau. See Keniapiskau.

Kanikawinika; lake, upper Ottawa river, east of Grand lake Victoria, Pontiac county, Que. (Not Kaniquonika nor Kanequaneka.)

Kanimitti; river, flowing into Shoshokwan river a tributary of the upper Ottawa, Pontiac county, Que. (Not Kanimittikoshkwa.)

Kanish; bay, S. of Granite point, Quadra island, Coast district, B.C. (Not Cahnish.)

Kanotaikau; lake, at headwaters of Rupert river, Mistassini territory, Que.

Kanuchuan; river, tributary to upper Attawapiskat river, Patricia district, Ont.

Kanus; river, trib. to St. Croix R., Charlotte Co., N.B. (Not Canous nor Canouse.)

Kanusio; lake, and river tributary to Kekek river, Pontiac county, Que.

Kaopskikamak; lake and river, southeast of Manitou lake, Kenora district, Ont.

Kaoskauta; lake, N.W. of Manitou L., Kenora district, Ont. (Not Kaoskowtakok.)

Kapemitchigama; lake, at the sources of Ottawa river, Joliette county, Que. (Not Kapemechigama.)

Kapesakosi; lake, west of Manitou lake, Kenora district. (Not Kapesakosikok.)
Kapikik; lake, S. of Cat L., Patricia, Ont. (Not Pine channel nor Wapikik lake.)
Kapikitegoitch; lake, headwaters of Ashuapmuchuan river, Chicoutimi county, Que.
Kapikwabikok. See Kabikwabik.
Kapiskau; river, N. of Albany R., Patricia, Ont. (Not Ka-pis-cow nor Kaypiscow.)
Kapitachuan; lake, and river tributary to the upper Ottawa river, Berthier, Joliette. Maskinonge, Montcalm and Pontiac counties, Que. (Not Kapitashewinna nor Kapitajewin.)
Kapitagama; lake, southeast of Abitibi lake, Timiskaming county, Que.
Kapitajewan. See Kapitachuan.
Kapitashewinna. See Kapitachuan.
Kapitswe; lake, at headwaters of St. Maurice river, Champlain county, Que.
Kapkichi; lake, north of L. St. Joseph, Patricia district, Ont.
Kaposvar; creek, tributary to Qu'Appelle river, Sask. (Not Little Cutarm.)
Karmutsen. See Nimpkish.
Kasagiminnis; lake, north of L. St. Joseph, Patricia district, Ont.
Kasakacheweiwak. See Uphill.
Kashagawi; lake, Stanhope Tp., Haliburton Co., Ont. (Not Kah-shah-gah-wig-e-mog.)
Kashagawigamog; lake, Dysart and Minden townships. Haliburton county, Ont.
Kashaweogama; lake, southwest of Savant lake, Thunder Bay district, Ont.
Kasiks; railway sta., also river tributary to Skeena R., B.C. (Not Ka-its-siks.)
Kaskawulsh; river, tributary to Alsek river, southwestern Yukon (Not O'Connor.)
Kasshabog; lake, Methuen Tp., Peterborough Co., Ont. (Not Kag-ish-a-bog-a-mog.)
Kate; point, at upper end of Lower Arrow lake, Kootenay district, B.C.
Katepwe; lake, an expansion of Qu'Appelle river, the eastern in the chain of the "Fishing lakes"—which see; also village, Sask.
Kates Needle; mountain, near Stikine R., opp. Porcupine creek, Cassiar district, B.C.
Kathawachaga; lake, south of Coronation gulf, N.W.T. (Not Cathawhachaga.)
Katharine; lake, at headwaters of Bow river, Rocky mountains, Alberta.
Katherine; lake, on Lady Evelyn river, below Grays river, Sudbury disitrict, Ont.
Kathlyn; lake, at east base of Hudson bay mountains, south of Moricetown, Coast district, B.C. (Not Chickens.)
Katina; creek, tributary to Silver Salmon river, Cassiar district, B.C.
Katonche; lake, east of Grand lake Victoria, Pontiac county, Que. (Not Kahuch.)
Katrina; creek, tributary to White river, Yukon.
Kattaktok; cape, east shore Ungava bay, New Quebec.
Katutok. See Charles.
Kauffman. See Kiwetinok.
Kawagama; lake, Sherborne Tp., Haliburton Co., Ont. (Not Kahwambejewagamog.)
Kawakashkagama. See Kawashkagama.
Kawasachuan; lake and river, near Grand L. Victoria, Timiskaming county, Que. (Not Kawasajewan nor Kawassajewan.)
Kawasgisgueyat. See Kawaskisigat.
Kawashegamuk; lake, southeast of Dinorwic lake, Kenora district, Ont. (Not Long.)
Kawasheibemagagamak. See Washeibemaga.

Kawashkagama; lake and river, north of Long lake, Thunder Bay district, Ont. (Not Kawakashkagama.)

Kawaskisigat; lake, headwaters of Lièvre river, St. Maurice county, Que. (Not Kawasgisguegat.)

Kawastaguta; bay, at the northerly end of Grand lake Victoria, Timiskaming, Que.

Kawaweogama; lake, northeast of Seseganaga lake, Thunder Bay district, Ont.

Kawawia; lake, southeast of Manitou lake, Kenora district, Ont. (Not Oval.)

Kawawiagamak. See Wawiag.

Kay-gat. See Keigat.

Kaypiscow. See Kapiskau.

Kazabazua. river, Ottawa and Pontiac counties; also railway station and village, Ottawa county, Que. (Not Kazubazua nor Kazuabazua.)

Kedgwick; river, Restigouche Co., N.B. (Not Kedgewick nor Quatawamkedgewick.)

Keec. See Kiekkiek.

Kee-ec-kee-ec. See Kiekkiek.

Keefer; island, at entrance to Key harbour, Georgian bay, Parry Sound district, Ont.

Keejimacoogie. See Kejimkujik.

Keele; peak, Mackenzie Yukon watershed, N.W.T.

Keepewa. See Kipawa.

Kee-she-kas. See Kishikas.

Keg; lake, on Churchill river, northeast of L. LaRonge, Saskatchewan. (Not Barrel.)

Keglo; bay, east shore Ungava bay, New Quebec.

Keheewin. See Kehiwin.

Kehiwin; Indian reserve, also lake, eastern Alberta. (Not Keheewin.)

Keigat; lake, southwest of Cat lake, Patricia district, Ont. (Not Kay-gat.)

Keikewabik; lake, south of Minnitaki lake, Kenora district, Ont. (Not Hawkrock.)

Kejimkujik; lake, Annapolis and Queens counties, N.S. (Not Cegemecega, Keja-makuja, Keejimacoogie, Kerjimacougie, nor Segum Sega.)

Kekek; river, tributary to Migiskan river, Pontiac county, Que.

Kekeko; lake, southeast of Abitibi lake, Timiskaming county, Que.

Kekekwa; lake, north of Anzhekumming lake, Kenora district, Ont.

Kekeo; river, tributary to Manuan R., upper St. Maurice R., Champlain county, Que.

Kekkekwabi; lake, Stanhope Tp., Haliburton Co., Ont. (Not Cay-ka-quah-be-kung.)

Kelsall; lake, discharging into Chilkat river, Cassiar district, B.C.

Kelvin; island, lake Nipigon, Thunder Bay district, Ont. (Not Grand.)

Kelvin; lake, an expansion of Nottaway river, Abitibi territory, Que.

Kelvingrove; post office, Huntingdon Co., Que. (Not Calvin Grove nor Kelvin Grove.)

Kematch; river, tributary to Woody river, western Manitoba.

Kempenfelt; bay, in lake Simcoe, Simcoe county, Ont. (Not Kempenfeldt.)

Kempt; lake, St. Maurice county Que. (Not Wabaskoutyunk.)

Kemptown; village, Colchester county, N.S. (Not Kempt Town.)

Kemptville; creek, tributary to Rideau R., Grenville Co., Ont. (Not South Rideau R.)

Kenemich; river, flowing to Melville lake, Ashuanipi, Que. (Not Kenemichic.)

Keniapiskau; lake, north of Opatawaga L., Abitibi territory, Que. (Not Kaniapiskau.)

Kenilworth; lake, in Tp. 50, R. 4, W. 4th M., Alberta.

Kennabutch; lake, east of Dinorwic lake, Kenora district, Ont. (Not Kennabuch.)

Ken-ne-big. See Kennibik.

Ken-ne-ses. See Kennisis.

Kennewapekko; lake, south of Boyer lake, Kenora district, Ont.

Kennibik; lake, Dudley township, Haliburton county, Ont. (Not Ken-ne-big.)

Kennicott; lake, at head of Hackett river, Cassiar district, B.C.

Kennisis; lake, Havelock township, Haliburton county, Ont. (Not Ken-ne-ses.)

Kenny; lake, west of lake Tempest, Thunder Bay district, Ont.

Kenogami; lake, township, and village, Chicoutimi county, Que.

Kenogami; river, tributary to Albany river, Algoma and Thunder Bay districts, Ont.

Kenogamissee. See Larch.

Kenoniska; lake, north of Opatawaga lake, Abitibi territory, Que.

Kenora; district and town, western Ontario. (Not Rat Portage town.)

Kenora; lake, Redditt township, Kenora district, Ont.

Kenozhe; lake, south of Machawaian lake, Patricia district, Ont.

Kenozhe; lake, southeast of Manitou lake, Kenora district, Ont. (Not Kinoje.)

Kerkeslin; mountain, south of Mt. Hardisty, east side of Athabaska river, Alta.

Kernertut. cape, southeast shore Ungava bay, New Quebec.

Kerr; mount, President range, Rocky mountains, Kootenay district, B.C.

Kerr; rocks off the western coast of Digby island, Coast district, B.C.

Kersey; point, at northerly end of Maitland I., Douglas channel, Coast district, B.C.

Kerwood; post village and railway station, Middlesex county, Ont. (Not Kerrwood.)

Keshkabuon; island, Thunder Bay district, Ont. (Not Caribou.)

Kestrel; rock, at entrance to Prince Rupert harbour, Coast district, B.C.

Ketch; harbour and head, also Ketch Harbour post settlement, southwest of entrance to Halifax harbour, Halifax county, N.S. (Not Catch harbour and head, nor White or Catch Harbour head.)

Ketchacum. See Catchacoma.

Ketchum; lake, northeast of Egnell, Cassiar district, B.C.

Kettle; point, and reef N. from the point, Lambton county, Ont. (Not Ipperwash.)

Kettle; range of mountains and river, Osoyoos and Similkameen districts, B.C.

Kettle. See Chaudière.

Ketza; river, tributary to Pelly river, above Ross river, Yukon. (Not Kitza.)

Kewagama; lake, southeast of Abitibi lake, Timiskaming county, Que.

Kewagodoongojioon. See La Pause.

Key; harbour and railway terminus, Georgian bay, Parry Sound district, Ont.

Keys; lake, north of Favel lake, Kenora district, Ont.

Khartum. See Hector.

Kiamika; lake, river, township, and village, Ottawa county, Que.

Kiask; river, south of Kamshigama river, Abitibi territory, Que.

Kickendatch. See Kikendatch

Kicking Horse; pass, and river tributary to Columbia river, Kootenay district, B.C. (Not Wapta river.)

Kid; creek, tributary to Goat river, Kootenay district, B.C.

Kiekkiek; lake, Bosquet township, Timiskaming, Q. (Not Keec nor Kee-ec-Kee-ec.)

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Kieley. See Coyle.

Ki-ette. See Kaiete.

Kiemawisk; lake, southwest of Shabogama lake, Timiskaming county, Que.

Kienawisik. See De Montigny.

Kikendatch; Indian village, upper St. Maurice river, Champlain county, Que. (Not Kirkendatch nor Kickendatch.)

Kikomun; creek, tributary to Kootenay river, north of Waldo, Kootenay district, B.C. (Not Kitamin, Kokamun, Mud, nor Rock.)

Kildala; arm, near Kitimat arm, Coast district, B.C.

Kildala; river, flowing into Kildala arm of Douglas channel, Coast district, B.C.

Killarney; village, on west side of Lower Arrow lake, Kootenay district, B.C.

Killsquaw; lake, northwest of Tramping lake, Sask.

Kilpatrick; mount, Purity range, Selkirk mountains, Kootenay district, B.C.

Kilvert; lake, south of Hawk lake, Kenora district, Ont.

Kimball; lake, Livingstone township, Haliburton county, Ont. (Not Kimball's.)

Kimmewin; lake, southwest of Schist lake, Kenora district, Ont.

Kinahan; islands, S. of Digby I., Chatham sound, Coast dist., B.C. (Not Kinnahan.)

Kinaskan; lake, a source of Iskut river, Cassiar district, B.C. (Not Iskut.)

Kinbasket; lake, an expansion of Columbia river, below Bush river, Kootenay district, B.C.

Kincardine; town, Bruce county, Ont.

King; mount, northwest of Ottertail station, Kootenay district, B.C.

King Christian. See Findlay.

Kingcome; inlet and mts., W. of Knight inlet, Coast district, B.C. (Not Kingcombe.)

Kingcome; point, at N. end of Princess Royal I., Coast dist., B.C. (Not Kingcombe.)

King George; sound, south shore of Hudson strait, New Quebec.

Kingham; river, Argenteuil county, Que. (Not Kingsey.)

Kinglake, post office, Norfolk county, Ont. (Not King Lake.)

King Oscar Land. See Ellesmere.

Kingscote; lake, Bruton township, Haliburton county, Ont.

Kingscourt; post office and railway junction, Lambton Co., Ont. (Not King's Court.)

Kingsey. See Kingham.

Kingsgate; post office and railway station, Int. boundary, Kootenay district, B.C.

King Solomon; mountain, east of Carmi, Similkameen district, B.C.

King William; island, S.W. of Boothia pen., N.W.T. (Not King William Land.)

Kinney; lake, at the southwest base of Mt. Robson, Cariboo dist., B.C. (Not Helena.)

Kinnickoneship; lake, near, Manitou L., Kenora district, Ont. (Not Black Sawbill.)

Kinnyu; lake, east of Manitou lake, Kenora district, Ont.

Kinoje. See Kenozhe.

Kinojevis; lake and river, Timiskaming county, Que. (Not Kinojeviskaskatik.)

Kinonge; river, Petite Nation seigniory, Labelle county, Que. (Not Salmon.)

Kinsman; post settlement, Kings county, N.S. (Not Kinsman's.)

Kintail; village, south of Clark point, Huron county, Ont.

Kipawa; lake, post office, and river, Timiskaming, Q. (Not Keepawa nor Kipewa.)

Kipling; reef, west of Middle Duck island, Manitoulin district, Ont.

Kipp; coulée, north of Middle coulée, southern Alberta. (Not Kipp's.)

Kirby; creek, flowing into Juan de Fuca strait, Vancouver I., B.C. (Not Coal.)

Kirk; island, in northerly portion of lake Evans, Abitibi territory, Que.

Kirkendatch. See Kikendatch.

Kirk Ferry; village, Hull township, Ottawa county, Que. (Not Kirk's Ferry.)

Kirkpatrick; lake, south of Hamilton lake, southeastern Alberta.

Kishikas; lake and river, tributary to Severn river, Patricia district, Ont. (Not Cedar, Kee-she-kas nor Kishki.)

Kishinena; creek and mountain, international boundary, Kootenay district, B.C. (Not Kishenehn, Kish-e-neh-na, nor Kish-e-nehu.)

Kishki. See Kishikas.

Kiskitto; lake, north of L. Winnipeg, Man. (Not Grass nor West Niskitogisew.)

Kiskittogisu; lake, north of L. Winnipeg, Man. (Not Big Reed nor Niskitogisew.)

Kiskopkechewans. See Minnehaha.

Kispiox; river, tributary to Skeena river, above Hazelton, Cassiar district, B.C (Not Kispyox nor Kis-py-ox.)

Kisseynew; lake, south of Kississing lake, Manitoba. (Not Lobstick.)

Kississing; lake and river, tributary to Churchill river, Manitoba. (Not Cold, Kissisino, nor Takipy.)

Kitamin. See Kikomun.

Kitchener; island, W. of Cockburn I., Manitoulin dist., Ont. (Not Little Cockburn.)

Kitchener; railway station, Kootenay district, B.C.

Kitchigama; river, trib. to Nottaway R., Abitibi territory, Que. (Not Michagama.)

Kitgargas; village, on Babine river near its junction with the Skeena, Cassiar district, B.C. (Not Kitgargasse.)

Kitigtung. See Lady Franklin.

Kitimat; arm and P.O., N. of Douglas channel, Coast district, B.C. (Not Kitamaat.)

Kitiwiti; shoal, southwest of Prospect, N.S. (Not Kittee Wittee.)

Kitkiata; Indian village, Douglas channel, Coast district, B.C. Not Kit-kia-tah.)

Kitsalas; canyon and town, on Skeena river, Coast district, B.C. (Not Kitselas.)

Kitselas. See Kitsalas.

Kitsumgallum; lake and river, tributary to Skeena river, Coast district, B.C. (Not Kitsumgalum nor Kit-sum-kay-lum.)

Kitty; shoal, S. of Great Duck I., and S.W. from Mary shoal, Manitoulin district, Ont.

Kitwanga; village, on Skeena river, 20 miles below Hazelton, Cassiar district, B.C.

Kitza. See Ketza.

Kiwanzi; brook, tributary to Burntwood river, Manitoba.

Kiwetinok; pass, peak, river, and valley, north of Amiskwi river, Rocky mountains, Kootenay district. B.C. (Not Mt. Kauffman, Wilson pass, nor Whymper pass.)

Kiyiu; lake, southeast of Opuntia lake, southern Saskatchewan. (Not Eagle.)

Kla-anch. See Nimpkish.

Klatsa; river, tributary to Frances river, Yukon. (Not Klatsatooa.)

Klemtu; passage and village, Coast district, B.C. (Not Klemtoo nor China Hat.)

Klesilkwa; river, tributary to Skagit river, Yale district, B.C.

Klewi; river, tributary to Little Buffalo R., S. of Great Slave L.,(Not Tesse-Clewee.)

Kloiya; bay, Denise arm, Morse basin, E. of Kaien I., Coast dist., B.C. (Not Cloyah.)

Klokhok; river, tributary to Takhini river, Yukon.

Klondike; village, and river tributary to Yukon river, Yukon. (Not Klondyke, Clondyke, nor Throndiuck.)

Klootchman; canyon, on Stikine river, south of Clearwater river, Cassiar district, B.C. (Not Kluchman.)

Klotassin; river, tributary to Donjek river, Yukon.

Klotz; mount, near Tatonduk river, Yukon.

Kluane; lake and river, in southwestern Yukon. (Not Kluahne.)

Kluchman. See Klootchman.

Kluhini; river, flowing out of Frederick lake into Dezadeash lake, Yukon.

Klukshu; lake, and river tributary to Alsek river, Yukon.

Klusha; creek, flowing through Braeburn lake, into Nordenskiöld river, Yukon.

Knapp; lake, north of Cheslatta lake, at head of Nechako river, Coast district, B.C.

Knapp; point, also Knapp Point lightstation, north shore of Wolfe island, Frontenac county, Ont. (Not Brown's.)

Knee; hills, between Kneehills and Threehills creeks, southern Alberta.

Kneehill; post office, east of Innisfail station, Alberta. (Not Knee Hill Valley.)

Kneehills; creek, tributary to Red Deer river, Alberta. (Not Knee Hills.)

Kneeland; bay, southwest shore Frobisher bay, N.W.T.

Knife; islands, west of Shute point, Bruce county, Ont.

Knife; lake, international boundary, Rainy River district, Ont.

Knight. See Descanso.

Knob; lake, Rugby township, Kenora district, Ont.

Knob. See The Knob.

Koak; islands and stream, St. John river, York county, N.B. (Not Coae nor Coak.)

Koidern; river, tributary to White river, Yukon.

Kokamun. See Kikomun.

Koketsa. See Kaketsa.

Kokomenhani; lake, at headwaters of Rupert river, Mistassini territory, Que. (Not Kokhamenhani.)

Kokomis; lake, southwest of Grand lake Victoria, Timiskaming county, Que.

Koksilah; railway station, ridge, and river, N. of Cowichan R., Vancouver I., B.C.

Koksoak; river, flowing into Ungava bay, New Quebec. (Not Big nor South.)

Kolfage; island, south of Pike point, Bruce county, Ont.

Koochiching; falls, in Rainy river, near Fort Frances, international boundary, Rainy River district, Ont. (Not Chaudière.)

Koos-ka-nax. See Kuskanax.

Kootanie. See Blakiston.

Kootenai. See Waterton.

Kootenay; lake and river, Kootenay district, B.C. (Not Kootanie, Kootenai, &c.)

Kopka; lake, west of lake Nipigon, Thunder Bay district, Ont.

Korikduardu; inlet, E. of Chorkbak inlet, Hudson strait. (Not Ko-rick-du-ar-du.)

Koshin; river, tributary to Nahlin river, Cassiar district, B.C.

Koya; point, also lightstation on the point, east of Langford point, N.E. entrance to Houston Stewart channel, Coast district, B.C.

Kramer; lake, Redditt township, Kenora district, Ont.

Kukukahu; lake, southeast of Manitou lake, Kenora district, Ont.

Kukukus; lake, southeast of Minnitaki lake, Kenora district, Ont. (Not Kukus.)

Kuldo; creek and village, Skeena river, 46 miles above Hazelton, Cassiar dist., B.C.

Kulleet; bay, northeast of Ladysmith harbour, Vancouver island, B.C. (Not Chemainos nor Chemainus.)

Kunghit; island, southernmost of Queen Charlotte Is., Coast dist., B.C. (Not Prevost.)

Kuper; island, northwest of Saltspring island, southeast coast of Vancouver island, B.C. The name "Kuper" is confirmed for this island and replaced by "Hibben" for the northerly one to avoid duplication.

Kuper. See Hibben.

Kusawa; lake, southwest of lake Laberge, Yukon. (Not Arkell.)

Kusawa; river, flowing northerly from Cassiar district, B.C., into Kusawa lake, Yukon. (Not Arkell.)

Kushog; lake, Stanhope township, Haliburton county, Ont. (Not Hall's nor Kah-wah-she-be-mah-gog.)

Kusiwah. See Surprise.

Kuskanax; creek, E. side of Upper Arrow L., Kootenay dist., B.C. (Not Koos-ka-nax.)

Kuskonook; P.O. and railway station, near the southern end of Kootenay lake, Kootenay district, B.C. (Not Kuskanook.)

Kutawagan; lake, Tp. 30, R. 20, W. 2 M., southern Saskatchewan.

Kuthai; lake, discharging into Silver Salmon river, Cassiar district, B.C.

Kwadacha; river, tributary to Finlay R., Cassiar, B.C. (Not Quadacha nor Quaneca.)

Kwichpak. See Yukon.

Kwinitsa; railway station, also river tributary to Skeena R., B.C. (Not Quinitsa.)

Kwoiek; peak, west of Kanaka, Yale district, B.C. (Not Quoieck.)

Kyak; bay, west coast Ungava bay, New Quebec.

Kyaska; lake, on Churchill river, east of Reindeer river, central Saskatchewan.

Kyeet. See Kaiete.

L

Laberge; lake, in the southern portion of Yukon. (Not Labarge nor Lebarge.)

Laberge; lake, Pontleroy township, Timiskaming county, Que. (Not Lizard.)

LaBiche; lake and river, northeastern Alberta. (Not Red Deer.)

Labrador; reef, south of Belanger point, Manitoulin island, Manitoulin district, Ont.

Labrador; reef, north of cape Chidley, New Quebec.

Labyrinth; lake, on interprovincial boundary, Timiskaming, Ont. and Que.

Lacaille; point and river, Montmagny county, Que. (Not la Caille.)

LaChapelle; post office, Two Mountains county, Que. (Not Lachapelle.)

L'Achigan. See Achigan.

La Colle. See Cole.

Lacroix; lake, southeast of L. LaBiche, central Alberta.

Lacroix; lake, in the valley of Bulkley river, Cassiar district, B.C. (Not La Croix, Le Croix, nor Round.)

LaCroix; lake, Int. boundary, Rainy R. dist., Ont. (Not Namoukan nor Nequaquon.)

Lac-Sergent; post office, Portneuf county, Que. See also Sergent (lac).

Ladder; hill and lake, southeast of Cowan lake, central Saskatchewan.

Ladue; river, tributary to White river, Yukon.

Lady Beatrix; lake, northeast of Mattagami lake, Abitibi territory, Que.

Ladybird; mountain, N. of Columbia R., Kootenay district, B.C. (Not Lady Bird.)

Lady Franklin; island, east of Clements Land, N.W.T. (Not Kitigtung.)

Ladysmith; harbour and town, southeast coast of Vancouver island, B.C. (Not Oyster harbour.)

LaFrance; creek, east side of Kootenay lake, Kootenay district, B.C. (Not Lafrance.)

Laggan; railway station, Alberta.

Lagoon; head, south entrance to Hammond bay, S.E. coast of Vancouver island, B.C.

Lahave; island and river, Lunenburg county, N.S. (Not La Have nor Le Havre.)

Lake; creek, tributary to Stewart river, Yukon.

Lake. See Chonat.

Lake Fleet; group of islands, E. of Admiralty group, St. Lawrence R., Leeds Co. Ont.

Lakelse; lake and river, tributary to Skeena river, Coast district, B.C. (Not Lekelse.)

Lake Megantic. See Megantic.

Lake of Islands. See Dufault lake.

Lake of the Narrows. See Washi lake.

Laketon; post on Dease lake, Cassiar district, B.C.

Lakit; creek, E. of Kootenay R., N. of Steele, Kootenay dist., B.C. (Not Four-mile.)

La Lime See Lanim.

La Loche. See Methye.

Lalonde; island, St. Lawrence river, Soulanges county, Que. (Not Chateauguay.)

L'Amable; brook and lake, Dungannon and Faraday townships, Hastings county, Ont.

Lamb; creek, tributary to Moyie river, Kootenay district B.C.

Lambert; shoal, northwest of Saugeen river, Bruce county, Ont.

Lamek; bay, Shippigan island, Gloucester county, N.B. (Not Alemek, Lamec, L'amec, nor Lameque.)

La Motte; lake, La Motte and Malartic townships, Timiskaming county, Que. (Not Askikwaj nor Seals Home.)

Lamy; lake, Sabourin township, Timiskaming county, Que. (Not Atikamek.)

Landels; river, tributary to Winefred river, eastern Alberta. (Not Grizzly Bear.)

Landing; lake, north of Sipiwesk lake, Manitoba.

Langara; island, off the northern extreme of Graham island, Queen Charlotte group; also point on the island, midway between Thrumb island and St. Margaret point, with lightstation thereon; name also applied to rocks off the north shore of the island; Coast district, B.C. (Not North island nor North point.)

The island was named North by Capt. George Dixon in 1787; and Langara by Commander Jacinto of the Spanish corvette "Aranzazu", 1792, after Admiral Don Juan de Langara of the Spanish navy and the point was called North by Vancouver, 1793. Walbran's "Coast Names of B.C." The name "North" objected to as not being sufficiently distinctive.

L'Ange Gardien. See Canrobert.

Langford; lake, west of Esquimalt, Vancouver island, B.C.

Langlais. See Langlois.

Langlois; point, at mouth of Grande rivière du Chêne, Lotbinière county, Que. (Not Langlais.)

Lanim; point, west of Dalhousie, Restigouche county, N.B. (Not La Lime, nor La Nim, nor Le Nim.)

La Nonne (lac); lake, Tp. 57, Rs. 2 and 3, W. 5th M., Alberta.

L'Anse au Beaufils. See Anse-à-Beaufils.

L'Anse-a-Valleau. See Anse-au-Vallon.

Lansdowne. mount, west of lake Marsh, Yukon.

La Pause; lake, La Pause township, Timiskaming, Que. (Not Kewagodoongojioon.)

Lapêche; lake and river, tributary to Gatineau river, Pontiac, Que.

Lapie; river, tributary to Pelly river, below Ross river, Yukon.

Laplante; post village, Gloucester county, N.B. (Not LaPlante.)

Larch; river, tributary to Koksoak river, New Quebec. (Not Kenogamissee.)

Lardeau; mining division, Kootenay district, B.C. (Not Lardo.)

Lardeau; mountains, east of Upper Arrow lake, Kootenay district, B.C.

Lardeau; river, tributary to Duncan river, Kootenay district, B.C. (Not Lardo.)

Lardeau; town, on Upper Arrow lake, Kootenay district, B.C. (Not Lardo.)

Larder; lake, south of Abitibi lake, Timiskaming, Ont. (Not Present nor President.)

Lardo. See Lardeau.

Lardo. See Purity.

L'Ardoise; village, Richmond county, N.S. (Not Ardoise.)

Large. See Hamilton.

Large Trout. See Hector.

LaRivière; railway station and village, Lisgar electoral district, Man. (Not Larivière.)

Lark; islet, northeast of pointe aux Alouettes, entrance to Saguenay river, Saguenay county, Que. (Not Ile aux Morts.)

Lark. See Alouettes.

La Ronde. See Rond.

LaRonge (lac); lake, south of Churchill river, central Saskatchewan.

Larry; rock, south of Great Duck I., and west of Kitty shoal, Manitoulin district, Ont.

Lartigue. See Lois.

LaSalette; town, Norfolk county, Ont. (Not La Sallette nor Lasallette.)

La Sarre; river, flowing from Makamik lake to Abitibi lake, Timiskaming county, Que. (Not Amikitik nor Whitefish.)

Lash; island, E. of Dead I., entrance to Key harbour, Parry Sound district, Ont.

Lasher; island, south of Shesheeb point, Thunder Bay district, Ont.

Laskay; post village, York county, Ont. (Not Laskey.)

Lasketti. See Lasqueti.

Lasquely. See Lasqueti.

Lasqueti; island, south of Texada island, strait of Georgia, New Westminster district, B.C. (Not Lasquely nor Lasketti.)

Last-Chance; creek, branch of Hunker creek, Klondike river, Yukon.

Latchford; town, on Montreal river, Timiskaming district, Ont.

La Tete. See Walton.

Laura; mount, near lower Stikine river, north of Iskut river, Cassiar district, B.C.

Laurie; lake in Duck Mountain Forest reserve, western Manitoba.

Laurie; range of mountains, west of O'Donnel river, Cassiar district, B.C.

Laurier; cove, in upper portion of Prince Rupert harbour, Coast district, B.C.

Laurier; lake, Pettypiece township, Kenora district, Ont.

Laurier; mount, east of lake Laberge, Yukon.

Laurier; river, emptying into the east end of Clinton-Colden lake, northeast of Slave lake, N.W.T.

Laussedat; mount, S. of Mt. Freshfield and N.E. of Donald, Kootenay district, B.C.

Lavallée; lake, northwest of Crean lake, central Saskatchewan. (Not Pelican.)

Lawrence; lake, north of DeLaronde lake, central Saskatchewan. (Not Caribou.)

Lawrence; lake, south of L. Winnipegosis, Man.

Lazy; lake, east of Kootenay R., north of Steele, Kootenay district, B.C. (Not Rock.)

Leach; creek, flowing northerly into Michel creek, Kootenay district, B.C. (Not South Branch or Fork of Michel creek.)

Leading peak. See mount Finlayson.

Leaf; bay, lake, and river, south coast of Ungava bay, Que. (Not Nepihjee river.)

Leah; peak, northwest of Samson peak, Rocky mountains, western Alberta.

Leak. See Thwartway.

Leanchoil; railway station, Kootenay district, B.C.

Leary; cove and point, entrance to Blind bay, Halifax county, N.S. (Not Leary's.)

Leask; bay and point, South bay, Manitoulin district, Ont.

Leather; river, tributary to Carrot river, Saskatchewan. (Not Hanging Hide.)

Lebarge. See Laberge.

Leboeuf; bay, Gabriola island, S.E. coast of Vancouver I., B.C. (Not Lebeuf.)

Lebret; lake, an expansion of Qu'Appelle river, above Katepwe lake, in the chain of the "Fishing lakes"—which see; also settlement; Sask.

Le Croix. See Lacroix.

Leda; peak, near "Castor" and "Pollox," east of mount Swanzy, Selkirk mountains, Kootenay district, B.C.

Lee; bank, north of Saugeen river, Bruce county, Ont.

Lee; creek, tributary to St. Mary river, southern Alberta. (Not Lee's.)

Leech; river, tributary to Sooke river, Vancouver island, B.C.

Leek. See Thwartway.

Lefroy; mount, also glacier, in the Bow range of the Rockies, Alta. and B.C.

Leg. See Muldrew.

Léger; post settlement, Westmorland county, N.B. (Not Legère Corner nor Legers Corners.)

Legère Corner. See Léger.

Le Have. See Lehave.

LeHeu; point, below Murray bay, Charlevoix county, Que.

Lelu; island, northwest of Smith island, Chatham sound, Coast district, B.C. (Not Le-loo nor South Porpoise.)

Lemoine; lake, Desroberts, Dubuisson and Laubanie townships, Timiskaming county, Que. (Not Kakinokamak.)

Le Nim. See Lanim.

Lenore; lake, north of Humboldt, Saskatchewan.

Leon; settlement, E. side of Upper Arrow L., Kootenay, B.C. (Not Leon Hot Springs.)

Leonard; island, St. Lawrence river, Soulanges county, Que. (Not Grand Batture.)

Leonard; mount, west of Surprise lake, Cassiar district, B.C.

Leopold; point, Markham bay, Hudson strait, N.W.T.

Leotta; creek, tributary to Klondike river, Yukon.

Le Pas. See Pas.

Lepreau; basin, harbour, parish, point, river, and village, Charlotte county, N.B. (Not Lepreaux nor Belas basin.)

Leroux. See Hill.

Lescarbot; lake, Quebec county, Que. (Not Kamamintigongue.)

Lesser Slave; lake and river, central Alberta. (Not Slave.)

Lester; lake, Haycock township, Kenora district, Ont.

L'Etang; harbour, river, and village, Charlotte county, N.B. (Not Etang nor Letang.)

L'Etete. See Letite.

Letite; passage and village, Charlotte county, N.B. (Not L'Etete nor Letete.)

Lève; lake, Radcliffe township, Renfrew county, Ont.

Levi. See Holliday.

Lewes; lake, near the "big bend" of Watson river, and river tributary to Yukon river, Yukon. (Not Lewis.)

Lewes; mount, north of lake Laberge, Yukon. (Not River mountain.)

Lewis; creek, east of Kootenay river, north of Steele, Kootenay district, B.C.

Lewis; island, between Kennedy and Porcher islands, Coast district, B.C.

Lewis; lake, northeast of Tawatinaw lake, Kenora district, Ont.

Lewis; lake, Ross river, Yukon.

Lewis. See Crease.

Lewis. See Lewes.

Lewis. See Louis.

Liard; river, tributary to Mackenzie R., B.C., N.W.T. and Yukon. (Not Mountain.)

Lichfield; shoal, W. entrance to Halifax harbour, Halifax Co., N.S. (Not Litchfield.)

Lièvres (île aux); island, St. Lawrence river, Temiscouata county, Que. English usage: Hare island, which see.

Lighthouse. See Snake.

Lilian; lake and river, tributary to the Assiniboine, from the north, eastern Saskatchewan. (Not Etoimami South.)

Lillooet; district, river, and town, B.C.

Lily; bay, upper Ottawa river, west of Grand L. Victoria, Timiskaming county, Que.

Lily; bay, also Lily Bay P.O., east shore of L. Manitoba, Man.

Lily; glacier, and pass, north of mount Swanzy, Selkirk Mts., Kootenay district, B.C.

Lily; lakes, on international boundary, Thunder Bay district, Ont.

Lima; point, S. extreme of Digby I., W. entrance to Prince Rupert harbour, B.C.

Limebank; village, Carleton county, Ont. (Not Lime Bank.)

Limestone; lake, Mayo township, Hastings county, Ont.

Limestone; point, Nipisiguit bay, Gloucester county, N.B. (Not Young's.)

Limestone. See Dolomite.

Lina; range of mountains, east of Atlin lake, Cassiar district, B.C.

Linda; lake, northeast of mount Odaray, Rocky mountains, Kootenay district, B.C.

Lindal; lake, Pettypiece township, Kenora district, Ont. (Not Lindel.)

Lindeman; lake, S. of Bennett L., Cassiar, B.C. (Not Linderman nor Lyndeman.)

Lindoe. See Lynedoch.

Lindsay; island, Admiralty group, St. Lawrence river, Leeds county, Ont. (Not Cut.)

Line; creek, tributary to Fording river, Kootenay district, B.C.

Line; lake, southwest of Eagle lake, Kenora district, Ont.

Lineham; creek, tributary to Sheep river, southern Alberta.

Link; island, near Dodd narrows, east coast of Vancouver island, B.C.

Link; lake, Strathy township, Nipissing district, Ont.

Linklater; creek, tributary to Kootenay river, near international boundary, Kootenay district, B.C. (Not Linkwater nor Meadow.)

Linklater; lake, east of Willard lake, Kenora district, Ont.

Linkwater. See Linklater.

Lionhead; harbour, headland, and village, Eastnor township, Bruce county, Ont. (Not Lion Head nor Lion's Head.)

Liscomb; harbour and post village, Guysborough county, N.S. (Not Liscombe.)

Liskeard; town, Timiskaming district, Ont. (Not New Liskeard.)

L'Isle. See Delisle.

Listowel; town, Perth county, Ont. (Not Listowell.)

Litchfield. See Lichfield.

Little; mount, west of mount Fay, Bow range of the Rockies, Alberta and Kootenay district, B.C.

Little; rock, southwest of Phœbe point, Fitzwilliam island, Manitoulin district, Ont.

Little. See Rough.

Little Atlin; lake, betweeen Atlin lake and lake Marsh, Yukon.

Little Black. See Belanger.

Little Black. See Burton.

Little Blanche; creek, branch of Quartz creek, Indian river, Yukon.

Little Boshkung; lake, Minden township, Haliburton county, Ont.

Little Bow; river, tributary to Belly river, Alberta. (Not Small.)

Little Bras d'Or; the narrow channel, east of Boularderie island, leading into St. Andrew channel, from the Atlantic, Cape Breton county, N.S. The name 'Little Bras d'Or lake' to be dropped.

Little Brazeau. See Nordegg.

Little Candle. See Torch.

Little Cedar. See Pakhoan.

Little Charlton. See Trodely.

Little Cockburn. See Kitchener.

Little Cutarm. See Kaposvar.

Little Don; river, tributary to Don river, York county, Ont. (Not Don.)

Little Fishing. See Peck.

Little Flatland. See Campbell.

Little Fork. See Gunamitz.

Little Fork of the Saskatchewan. See Mistaya.

Little-gem; creek, branch of Hunker creek, Yukon.
Little Grant. See Pearson.
Little Green. See Steevens.
Little Island (lake). See Ministikwan.
Little Jackfish. See Foreleg.
Littlejohn; island, Admiralty group, St. Lawrence river, Leeds county, Ont.
Little Knife; portage, between Knife and Cypress lakes, Rainy R. district, Ont.
Little Loran. See Little Lorembec.
Little Lorembec; post settlement, midway between Lorembec and Cape Breton, Cape Breton county, N.S. (Not Little Loran nor Little Lorraine.)
Little Lorraine. See Little Lorembec.
Little Madawaska; river, E. side of Algonquin National park, Nipissing district, Ont.
Little Magog. See Magog.
Little Mecattina. See Mekattina.
Little Mistassini. See Albanel.
Little Musquodoboit; village, Halifax county, N.S. (Not Little River Musquodoboit.)
Little Natashquan. See Natashkwan.
Little Nation. See South Nation.
Little Nipisiguit. See Millstream.
Little Nottaway. See Broadback.
Little Opeongo. See Aylen.
Little or South Miminigash. See Roseville.
Little Pelican. See Suggi.
Little Quill. See Quill.
Little Red. See Spruce
Little River Musquodoboit. See Little Musquodoboit.
Little Roger. See Gaboury.
Little Sachigo. See Oponask.
Little Salmon; river, tributary to Lewes river, Yukon.
Little Sandy. See Athol.
Little Saskatchewaen. See Dauphin.
Little Saskatchewan. See Minnedosa.
Little Shallow. See Pakwash.
Little Shuswap; lake, west of Shuswap lake, Kamloops district, B.C.
Little Slave. See Prince Regent.
Little Slocan; river, tributary to Slocan river, Kootenay district, B.C.
Little Smoky; river, tributary to Smoky river, Alberta.
Little Tahltan; river, tributary to Tahltan river, Cassiar district, B.C.
Little Tobique. See Sisson.
Little Tobique. See Tobique.
Little Vermilion; lake, between Loon and Sand Point lakes, international boundary, Rainy River district, Ont. (Not Vermilion.)
Little Vermilion. See Altrude.
Little Wabigoon. See Dinorwic.
Little Weslemcoon. See Effingham.
Livingstone; range of mountains and river, southern Alberta.

Lizard; creek and mountains, southwest of Fernie, Kootenay district, B.C.

Lizard. See Laberge.

Lladnor; creek, tributary to Elk river, north of Olson, Kootenay district, B.C.

Llewellyn; glacier, south of Atlin lake, Cassiar district, B.C.

Loadstone. See Lodestone.

Lobster; lake, Airy township, Nipissing district, Ont.

Lobster. See Crayfish.

Lobstick; bay, in the lake of the Woods, Kenora district, Ont. (Not Lob-stick.)

Lobstick; river, tributary to Pembina river, central Alberta. (Not Lob-stick.)

Lobstick. See Chip.

Lobstick. See Kisseynew.

Lock; bay, Gabriola island, southeast coast of Vancouver island, B.C.

Locke; island, Lockeport harbour, Shelburne county, N.S. (Not Ragged nor Rugged.)

Lockeport; harbour, also town on Locke island, Shelburne county, N.S. (Not Ragged or Rugged Island harbour.)

Lockhart; river, emptying into E. end of Great Slave L., N.W.T. (Not Lockhart's.)

Lodestone; lake and mountain, south of Tulameen river, Yale district, B.C. (Not Loadstone mountain nor Paradise lake.)

Lodge; creek, southern Alberta and Saskatchewan. (Not Medicine Lodge.)

Lodgepole; creek, tributary to Wigwam river, Kootenay, B.C. (Not Lodge Pole.)

Logan; island, in northerly portion of lake Nipigon, Thunder Bay district, Ont.

Logan; mount, east of Frances lake, Yukon.

Logie; rock, west of McNab point, Bruce county, Ont.

Lois; lake and river, emptying into Makamik lake, Timiskaming county, Que. (Not Lartigue, Matamik, nor Molesworth.)

Loks Land; at entrance to Frobisher bay, N.W.T. (Not Lok's Land.)

Lombard; creek, tributary to Indian river, Yukon.

Lomond; river, emptying into L. Superior, Thunder Bay district, Ont. (Not Carp.)

London Junction. See Pottersburg.

Lonely, bay, east of Dominion point, Manitoulin island, Manitoulin district, Ont.

Lonely; river, flowing into bay of same name, Opasatika lake, Timiskaming, Que. (Not Bagwah.)

Lonely. See Isolated.

Lonely. See Seul.

Lonely Valley. See Ten Peaks.

Lone Man's. See Oneman.

Lone Tree. See Ann.

Long; creek, the west branch of Souris river, southeastern Saskatchewan.

Long; point, extending into the central portion of lake Evans, Abitibi territory, Que.

Long; point, in southern part of Tyendinaga township, Hastings county, Ont.

Long; portage, between Rose and Watap lakes, international boundary, Thunder Bay district, Ont. (Not Great New.)

Long. See Farrell.

Long. See Kawashegamuk.

Long. See Lowes.

Long. See Methy.

Long. See Mountain.

Long. See Ord.

Long. See St. Andrew.

Long. See Trident.

Long. See Tyee.

Long. See Vaudray.

Long. See Wolfe.

Long. See Woods.

Long-legged; lake and river, emptying into Wilcox lake on English river, Patricia district, Ont.

Long Point; bay and lightstation, lake Erie, Norfolk county, Ont. (Not North Foreland nor Outer Bay of Long Point.)

Long Sault; rapids, below Manitou rapids, Rainy river, Rainy River district, Ont.

Longspell; point, near Kingsport, Kings county, N.S. (Not Indian.)

Longue-Pointe; village, Hochelaga county, Que. (Not Long Point.)

Lookout; mountain, in the Selkirks, Kootenay district, B.C.

Lookout; river, emptying into Smoothrock lake, Thunder Bay district, Ont.

Loon; lake, between LaCroix and Little Vermilion lakes, international boundary, Rainy River district, Ont.

Loon. See Makwa.

Loon. See Mang.

Loonhead; lake, on Burntwood river, Manitoba. (Not Loon-head)

Loop; brook, tributary to Illecillewaet river, near "The Loop," Kootenay district, B.C.

Lorembec; head and post settlement, about 2 miles east of Louisburg, Cape Breton county, N.S. (Not Big Loran nor Big Lorraine.)

The original form of this name was Laurentbec (See page 175 of "Cape Breton and its Memorials." by Sir John Bourinot) which survives in the neighbouring "Lawrence head"; this successively became "Laurentbec"; "Lorembec"; and "Lorembee", evidently a typographical error; "Loran", probably a corruption of Laurent; and lastly "Lorraine", evidently adopted from the name of the Rhenish province under a misconception.

Lorenzo. See Pelletier.

Loretta; island, north of Hawkesbury island, Coast district, B.C.

Lorette; parish, railway station, and village, southeast of Winnipeg, Manitoba. (Not Loretto.)

L'Orignal; town, Prescott county, Ont. (Not L'Original.)

Lorne; lake, Rugby township, Kenora district, Ont.

Lorne; lake, Pembina river, southern Manitoba.

Lorne; mount, west of lake Marsh, Yukon.

Lorneville; village, on west side of entrance to St. John harbour, St. John county, N.B. (Not Pisarinco.)

Lorrain; lake, east of Cassels township, Timiskaming district, Ont. (Not Bear.)

Loscombe; reef, north of Macpherson point, Bruce county, Ont.

Lost; lake, northwest of Minnitaki lake, Kenora district, Ont.

Loucks; lake, Burleigh township, Peterborough county, Ont. (Not Louck's.)

Lougheed; bay, point and reef, east of Dominion point, Manitoulin island, Ont.

Louis; mount, northwest of Banff, Alberta.

Louis; point, south end of Coste island, Kitimat arm, Coast district, B.C.

Louis; port, Graham island, Coast district, B.C. (Not Ingraham nor Lewis.)

Louisa; lake, Lawrence township, Haliburton county, Ont.

Louise; lake, west of Laggan station, Alberta. (Not Emerald.)

Louise; lake, Pembina river, also railway station, southern Manitoba.

Lount; lake, English river, Kenora district, Ont.

Loup (banc du); bank, below Pilgrim Is., St. Lawrence R., Temiscouata Co., Que.

Loup (pointe du); (rivière du); point, also river tributary to the St. Lawrence, Temiscouata county, Que.

Loutre; Harbour de, harbour, W. side of Campobello I., N.B. (Not Harbour de Lute.)

Loutres. See Glaises.

Low; lake, southeast of Silver lake, Kenora district, Ont.

Low; point, and Low Point post office, east side of George bay, Inverness county, N.S.

Low. See Clark.

Low. See Flat

Lower Arrow; lake, an expansion of Columbia river, Kootenay district, B.C.

Lower Bow. See Hector.

Lower Clearwater. See Washagomish.

Lower Savage; islands, Gabriel strait, N.W.T.

Lower White Fish. See Gregg.

Lowes; lake, southwest of Yorkton, Saskatchewan. (Not Long, Pebble, nor Silver.)

Lubbock; bay, west of Markham bay, Hudson strait, N.W.T.

Lubbock; river, flowing into Atlin lake from Little Atlin lake, Yukon.

Lucas; channel, island, and reef, at entrance to Georgian bay, Manitoulin district, Ont

Lucky; creek, branch of Allgold creek, Klondike river, Yukon.

Luke; creek, tributary to St. Mary river, Kootenay district, B.C.

Luke Fox. See Fox.

Lumley. See Frobisher.

Lusk; creek, tributary to Kananaskis river, Alberta.

Lussier; river, tributary to Kootenay river, Kootenay district, B.C.

Lutz, post settlement, Westmorland county, N.B. (Not Lutes nor Lutes Mountain.)

Lyal; island and reef, southeast of Greenough point, Bruce county, Ont.

Lychnis; mountain, south of Mt. Douglas, Rocky mountains, Alberta.

Lyell; mount, also creek and snowfield, summit range of the Rockies, Alta. and Kootenay district, B.C.

Lynch; island, in the Ste. Genevieve group, east of Ste. Anne-de-Bellevue, Jacques Cartier county, Que. (Not Dowker's nor Lynch's.)

Lyndeman. See Lindeman.

Lynedoch; island, west of Hill island, St. Lawrence river, Leeds county, Ont. (Not Ash, Lindoe, nor Lyndoch.)

Lynn; point, Manitoulin I., N.W. of Greene I., Manitoulin dist., Ont. (Not Black.)

Lynx. See Selby.

Lyster; lake, Barnston township, Stanstead county, Que. (Not Baldwin's pond nor Barnston pond.)

M

Mabee; village, Norfolk county, Ont. (Not Maybee.)

Mabel; lake and mountain, Kamloops and Osoyoos districts, B.C.

Macabee; creek, tributary to Sheep river, also mountain, southern Alberta.

McAdam; Ry. sta. and village, York Co., N.B. (Not Macadam nor McAdam Junction.)

McAlpine; P.O. and Ry. station, Prescott Co., Ont. (Not McAlpine's nor McAlpin.)

Macan. See Maccan.

McArthur; creek, lake, and pass, west of Columbia river; also mountain, at head of upper Yoho valley, Rocky mountains, Kootenay district, B.C.

Macaulay; lake, Airy township, Nipissing district, Ont.

Macaulay; spit, off the southeastern end of Inner Duck island, Manitoulin district, Ont. (Not McCauley's.)

McBean; mount, west of Mt. Purity, Selkirk mountains, Kootenay district, B.C.

McCallum; island, southeast of Beament island, Bruce county, Ont. (Not Snake.)

McCallum; mountains, east of Atlin lake, Cassiar district, B.C.

Maccan; railway station, river, and village, Cumberland county, N.S. (Not Macan.)

McCarthy; point, southeast side of Fitzwilliam island, Manitoulin district, Ont.

M'Clintock; peak and river, between lake Marsh and Teslin river, Yukon. (Not McClintock.)

McConnell; peak and river, Nisutlin river, Yukon.

Macoostigan. See Makustigan.

McCormick; creek and landing, near foot of Lower Arrow lake, Kootenay district, B.C. (Not McCormack.)

McCoy; head, east of Thompson cove, St. John county, N.B. (Not McCoy's.)

McCoy; island, Brock group, St. Lawrence R., Leeds Co., Ont. (Not Montgomery.)

McCreary; island, N. of Turnagain point, L. Winnipeg, Man. (Not Outer Sturgeon.)

McDame; creek, tributary to Dease river, Cassiar district, B.C.

McDonald; bay and point, west of Brockville, Leeds county, Ont. (Not Donald, Macdonald, nor McDonald's.)

McDonald; creek, flowing into Upper Arrow lake, Kootenay district, B.C.

McDonald; island, Admiralty group, St. Lawrence R., Leeds county, Ont. (Not Hog.)

McDonald; lake, east of Atlin lake, Cassiar district, B.C.

McDonald; lake, Haycock township, Kenora district, Ont.

McDonald; mount, west of Esquimalt, Vancouver island, B.C

Macdonald; island, N.W. of the islands of God's Mercie, Hudson strait. (Not Egypt.)

Macdonald; lake, Havelock township, Haliburton county, Ont. (Not Macdonald's.)

Macdonald; mount, in the Selkirks, Kootenay district, B.C. (Not Carroll.)

Macdonald; range of mountains, east of Wigwam river, Kootenay district, B.C.

McDonald's. See Prince Regent.

McDougal; brook, trib. to Incomappleux R., Kootenay dist., B.C. (Not McDougall.)

McDougall; mount, east of Kananaskis river, Rocky Mountains park, Alberta.

Macdougall; settlement, Kent county, N.B. (Not Macdougal nor Macdougall's.)

Macdougall's. See Marion.

Mace; bay, Charlotte county, N.B. (Not Mace's.)

McElhinney; shoal, N. of Flowerpot I., Georgian bay, Ont. (Not McElhinney's.)

McEvoy; creek, tributary to Flathead river, east of Morrissey, Kootenay district, B.C.

McEwen; lake, east of Kawaweogama lake, Thunder Bay district, Ont.

McFadden; lake, McClintock township, Haliburton county, Ont. (Not McFadden's.)

McFarlane; river, emptying into the S. side of Athabaska lake, Sask. (Not Beaver.)

McGaw; point, entrance to S. Baymouth, Manitoulin island, Manitoulin district, Ont.

McGillivray; creek, flowing southeasterly into Anderson lake, also mountain and pass at the head of the creek, Lillooet district, B.C. (Not McGillvray.)

McGillivray; post office, Middlesex county, Ont. (Not West McGillivray.)

McGillvray. See McGillivray.

McGrath; mount, near lower Stikine R., north of Iskut R., Cassiar district, B.C.

MacGregor; point, west of Port Elgin, Bruce county, Ont.

McGregor; settlement, east shore of Kootenay lake, south of Lockhart creek, Kootenay district, B.C. (Not McGregor's.)

Macha. See Hatchau.

Machawaian; lake, southwest of Attawapiskat lake, Patricia district, Ont.

McHugh; brook, flowing into Dinorwic L., Kenora dist., Ont. (Not McHugh's creek.)

McInnes; post office, Middlesex county, Ont. (Not McInness.)

McInness. See McInnes.

McIntosh; mount, east of Atlin lake, Cassiar district, B.C.

McIntosh; village, Leeds county, Ont. (Not MacIntosh Mills.)

McIntyre; bay, south shore of L. Suel, Kenora district, Ont.

McIntyre; bay, south shore of lake Nipigon, Thunder Bay district, Ont.

Mackay; lake, Gloucester township, Carleton county, Ont. (Not Hemlock.)

McKay; H. B. Co. post, also settlement on Athabaska R., Alta. (Not Fort McKay.)

McKay; lake, south of Nanaimo river, Vancouver island, B.C.

McKay; mount, S.W. of Fort William, Thunder Bay district, Ont. (Not McKay's.)

McKay; reach, between Princess Royal and Gribbell islands, Coast district, B.C.

McKay; rock, S.W. from Pulpwood point, Cockburn I., Manitoulin district, Ont.

McKay; river, flowing northeasterly into Athabaska R. at McKay, Alta. (Not Red.)

McKee; creek, north of O'Donnel river, Cassiar district, B.C.

McKellar; channel (middle) of Kaministikwia river, Thunder Bay district, Ont. (Not McKellar river.)

McKellar; island, south of Pie island, Thunder Bay district, Ont.

McKellar; point, southwest of Victoria island, Thunder Bay district, Ont.

McKenzie; creek, flowing into Grand river, Brant and Haldimand counties, Ont. (Not Mackenzie.)

McKenzie; lake, Nightingale township, Haliburton county, Ont. (Not McKenzie's.)

Mackenzie; lake, S. of N. T. Ry., N.W. of L. Nipigon, Thunder Bay district, Ont.

Mackenzie; mount, southeast of Revelstoke, Kootenay district, B.C. (Not McKenzie.)

Mackey; point, Sheen township, Pontiac county, Que. (Not Mackay.)

McKim; bay, west shore South bay, Manitoulin island, Ont. (Not McKimm.)

McLaren. See McLaurin.

McLaughlin. See McLoughlin.

McLaurin; bay, east of East Templeton, Ottawa county, Que. (Not MacLaren.)

McLaurin; lake, northwest of lake Nipigon, Thunder Bay district, Ont.

McLay; mount, east of Surprise lake, Cassiar district, B.C.

McLean; canyon, below the Grand falls of Hamilton river, Ashuanipi and New Quebec. (Not Bowdoin.) Named after John McLean, an officer of the H. B. Co. who discovered the falls and canyon in 1829.

McLean; mountain, north of mouth of Cayoosh creek, Lillooet district, B.C.

McLean; rock in Fitzwilliam channel, Manitoulin district, Ont.

McLean. See McLelan.

McLelan; strait, northeast shore Ungava bay, New Quebec. (Not McLean.)

McLennan; lake, Haycock township, Kenora district, Ont.

Macleod; lake, Tp 51, R. 16, W. 3 M., Saskatchewan.

Macleod; town and railway station, southern Alberta. (Not Fort Macleod.)

McLeod; mount, west of Dease lake, Cassiar district, B.C.

McLeod; river, tributary to Athabaska river, central Alberta.

McLoughlin; bay, Lama passage, Coast district; also point in Victoria harbour; B.C. (Not M'Laughlin, Maclaughlin, nor McLaughlin.)

McMahon; island, off the southeast side of Grenadier island, St. Lawrence river, Leeds county, Ont. (Not Shantee nor Shanty.)

McMaster; lake, Jones township, Renfrew county, Ont. (Not McMaster's.)

McMaster; mount, east of O'Donnel river, Cassiar district, B.C.

Macmillan; range of mountains, and river tributary to Pelly river, Yukon.

MacMillan; railway station, Kenora district, Ont.

McMillan. See Balache.

McMullen. See Carnarvon.

McMurray; H. B. Co. post, also settlement on Athabaska river, northeastern Alberta. (Not Fort McMurray.)

McNab; point, south of Chantry island, Bruce county, Ont.

McNair; island, St. Lawrence river, below Brockville, Leeds county, Ont.

McNeil; mount, betweeen Watson and Wheaton rivers, southern Yukon.

McNevin; lake, Murchison township, Nipissing district, Ont. (Not McNevin's.)

McNicoll; mount, southwest of Sixmile Creek station, Kootenay district, B.C.

McNutt; island, Shelburne harbour, Shelburne county, N.S. (Not McNutt's.)

Macoming. See Chiblow.

Macoostigan. See Makustigan.

McPhee; bay, northern shore of lake Simcoe, Simcoe county, Ont.

McPherson; lake, north of Frances lake, Yukon.

Macpherson; mount, southwest of Revelstoke, Kootenay district, B.C.

Macpherson; point, northeast of Douglas point, Bruce Co., Ont. (Not McPherson.)

Macoun; mount, northwest of mount Fox, Selkirk mountains, Kootenay district, B.C.

Macquereau. See Maquereau.

McQuesten; river, tributary to Stewart river, Yukon. (Not McQuestion.)

McRae; point, south of Douglas point, Bruce county, Ont.

McReynolds; post office, Grenville county, Ont. (Not McReynold's Corners.)

McReynold's Corners. See McReynolds.

Mad; reef, between Greenough point and Lyal island, Bruce county, Ont.

Madawaska; post office, Nipissing district, Ont.

Madawaska; river, tributary to Ottawa river, Renfrew county, Ont.

Madendanada. See Tendinenda.

Madge; lake, in Tps. 30 and 31, R. 30, W. P. M., Sask. (Not Clear Water.)

Maduxnakeag. See Meduxnekeag.

Maganasibi; river, tributary to Ottawa river, Timiskaming county, Que. (Not Maganacipi nor Maganasipi.)

Maganatawan; post office and river, Parry Sound district, Ont. (Not Magnetawan nor Maganetawan.)

Maggie; lake, Finlayson township, Nipissing district, Ont. (Not Maggie's.)

Magnet; channel, island, and point, S.E. entrance Black B., Thunder Bay dist., Ont.

Magnetawan. See Maganatawan.

Magnetic; island and reef, southeastern side of Cockburn I., Manitoulin district, Ont.

Magnetic; lake, W. of Gunflint L., international boundary, Thunder Bay district, Ont.

Magog; lake and river, tributary to St. Francis river, Sherbrooke and Stanstead counties, Que. (Not Little Magog lake.)

Magog; lake, in Mack township, Algoma district, Ont.

Maguacha. See Maguasha.

Maguasha; point and post office, Nouvelle township, Bonaventure county, Que. (Not Goacha, Maguaacha, Migaocha, nor Miguasha.)

Maguire; mount, east of Sooke inlet, Vancouver island, B.C. (Not McGuire.)

Magusi; river, flowing northeasterly into Duparquet lake, Timiskaming, Ontario and Quebec. (Not Agotawekami, Asipimocasi, nor Isabemagussi.)

Mahmee. See Mami.

Mahogany. See Manawagonish.

Maiden. island, south shore Hudson strait, New Quebec. (Not Maiden Paps.)

Maiden; island, east of Michael point, Manitoulin island, Manitoulin district, Ont.

Maikasksagi; river, north of Waswanipi river, Abitibi territory, Que.

Mailloux; river, flowing into the St. Lawrence, at Murray Bay, Charlevoix Co., Q.

Main; channel, between Cove island and "Bad Neighbour" rock, entrance to Georgian bay, Bruce county, Ont.

Mainadieu; bay, lightstation, passage, and village, Cape Breton county, N.S. (Not Main à Dieu, Main-à-dieu nor Menadou.)

Maitland; island, Douglas channel, north of Hawkesbury island, Coast district, B.C.

Maitland; river, emptying into lake Huron at Goderich, Huron county, Ont.

Maitland. See Port Maitland.

Makamik; lake, Royal Rouissillon township, Timiskaming, Que. (Not Mekamic.)

Makokibatan; lake, Albany river, Patricia and Thunder Bay districts, Ont.

Makustigan; lake, S. of Wetetnagami L., Pontiac county, Que. (Not Macoostigan.)

Makwa; lake and river, trib. to Beaver R., from the southwest, Sask. (Not Loon.)

Malahat; ridge, west of Saanich inlet, Vancouver island, B.C. (Not Beddingfield.)

Malaspina's. See Galiano.

Malbaie (rivière); river, tributary to the St. Lawrence, Charlevoix county, Que. (Not Malbay.) English usage: Murray river, which see.

Malbaie; See also **Murray Bay.**

Malcolm; reef, between Boyer reef and Port Elgin, Bruce county, Ont.

Malcolm; river, flowing northeasterly into Arctic ocean, international boundary, Alaska and Yukon.

Mâle (lac du); lake, at headwaters of St. Maurice river, Champlain county, Que.

Maligne; lake and river, emptying into the Athabaska at 'Henry House,' also mountain east of the lake, Rocky mountains, western Alberta.

Mallon; lake, in Rattray township, Timiskaming district, Ont.

Maloney; mount, northwest of Aishihik lake, Yukon.

Malpeque; bay, Prince county, P. E. I. (Not Richmond.)

Mamakwash; lake, at headwaters of Berens R., Patricia district, Ont. (Not Fairy.)

Mameigwess; lake, north of Attawapiskat lake, Patricia district, Ont.

Mami; creek, tributary to Belly river, southern Alberta. (Not Buffalo, Fish, nor Mahmee.)

Mamozekel; river, tributary to Tobique river, Northumberland and Victoria counties, N.B. (Not Mamoxekel nor Momozekel.)

Manasan; river, tributary to Burntwood river, Manitoba. (Not Munosahn.)

Manawagonish; island, in St. John harbour, St. John county, N.B. (Not Mahogany, Manawoganish, nor Meogenes.)

Manawan; lake, on Churchill river, below Reindeer river, central Saskatchewan.

Mance; lake, La Sarre township, Timiskaming county, Que. (Not Mud.)

Mandamin; post village and railway station, Lambton Co., Ont. (Not Mandaumin.)

Mang; lake, west of Kawawia lake, Kenora district, Ont. (Not Loon.)

Manganese; mountain, east of Ice river, Rocky mountains, Kootenay district, B.C.

Manicouagan. See Manikuagan.

Manicuagan. See Manikuagan.

Manigotagan; lake and river, east of lake Winnipeg, Man. (Not Bad Throat river, Muskrat lake, nor Rat Portage lake.)

Manikuagan; point and river, Saguenay Co., Q. (Not Manicouagan nor Manicuagan.)

Manito; lake, south of Battle river, Saskatchewan.

Manitoba; large lake of Manitoba.

Manitoba; ledge, off W. side of Yeo I., entrance to Georgian bay, Manitoulin dis., Ont.

Manitoba; reef, north of Great Duck island, Manitoulin district, Ont.

Manitou; creek, flowing into Michael bay, Manitoulin island, Manitoulin district, Ont.

Manitou; lake, northwest of lake Nipigon, Thunder Bay district, Ont.

Manitou; rapid, Rainy river, international boundary, Rainy River district, Ont.

Manitou. See Silver.

Manitoulin; island, Manitoulin district, Ont. (Not Grand Manitoulin.)

Manitoulin gulf. See South bay.

Manitounuk; sound, north of Great Whale river, New Quebec. (Not Manitounuck.)

Manitowaning; bay and village, Manitoulin district, Ont. (Not Manitouaning.)

Manitumeig; lake, west of Anzhekumming lake, Kenora district, Ont.

Manitush; lake, southwest of Attawapiskat lake, Patricia district, Ont.

Mann; island, in upper part of lake Timiskaming, Que.

Mann; island, east of Bigsby island, at entrance to Key harbour, Georgian bay, Parry Sound district, Ont.

Manomin; lake, west of Winnange lake, Kenora district, Ont. (Not Unaminnikan.)

Manquart. See Monquart.

Manseau; parish and post office, Nicolet county, Que.

Mansel; island, Hudson bay, N.W.T. (Not Mansfield.)

Mansfield; creek, tributary to Tatshenshini river, Cassiar district, B.C. (Not Bear.)

Mansfield. See Mansel.

Mantagao; river, flowing northerly into Sturgeon bay, lake Winnipeg, Manitoba.

Manuan; lake, and river tributary to the upper St. Maurice, Champlain county, Que. (Not Manouan.)

Manuminan. See Paint.

Many Island; lake, east of Medicine Hat, Alberta and Saskatchewan.

Maple; bay and mountain, W. Sansum narrows, Stuart channel, Vancouver I., B.C.

Maple; creek flowing into Bigstick lake, also Maple Creek town, southwestern Sask.

Maple; island, St. Lawrence R, Soulanges county, Que. (Not D'Alogmy nor Thorn.)

Maple; point, at the northeast end of Gil island, Coast district, B.C.

Maple. See Goosehunting.

Maplegrove; post office, Middlesex county, Ont. (Not Maple Grove.)

Maquereau; point, Gaspe county, Que. (Not Macquereau.)

Mara; lake, east of Salmon arm of Shuswap lake, Kamloops district, B.C. (Not Mara arm of Shuswap lake.)

Marble; canyon, a very narrow deep pass through the range of mountains between Bonaparte and Fraser rivers, Lillooet district, B.C.

Marble Dome; mountain, S. of Gladys lake, Cassiar dist., B.C. (Not Brown Dome.)

Margaree; town, Inverness county, N.S. (Not Margaree Harbour.)

Margaret; lake, northeast of Turquoise lake, Alberta.

Margaret; lake, at headwaters of Wenasaga R., Patricia, Ont. (Not Kakinookama.)

Margaretville; village, on the bay of Fundy, Annapolis county, N.S. (Not Margaretsville.)

Marguerite; bay, point, and river, north shore of lower St. Lawrence, Saguenay county, Que. (Not Ste. Marguerite.) To avoid duplication, see Ste. Marguerite river, Chicoutimi county.

Maria; lake, northwest of Tuya lake, Cassiar district, B.C.

Maria; lake, Purdom township, Thunder Bay district, Ont.

Marieville; railway station and village, Rouville county, Que.

Marieville creek. Se Huron river.

Marina; island, S.W. of Cortes I., Sutil channel, Coast district, B.C. (Not Mary.)

Marion; lake, west of Glacier station, Kootenay district, B.C.

Marion; point, near Dorval, Jacques Cartier county, Que. (Not Macdougall's.)

Marion. See Allan.

Marjorie; island, westward of Sandys point, St. Peters inlet, Richmond county, N.S. (Not Gooseberry.)

Mark; creek, tributary to St. Mary river, Kootenay district, B.C.

Mark; lake, northeast of Silver lake, Kenora district, Ont.

Markham; bay, northeast shore of Hudson strait, N.W.T.

Marksville. See Hilton.

Marmen; rock, east of Brandypot channel, St. Lawrence R., Temiscouata Co., Que.

Marmot; mountain, north of Observation peak, Rocky mountains, Alberta.

Marpole; mount, also lakes, at headwaters of Yoho river, Kootenay district, B.C.

Marsh; lake, in the southern portion of Yukon, near Bennett and Tagish lakes.

Marshall Cove. See Port Lorne.

Marshall; lake, northeast of lake Nipigon, Thunder Bay district, Ont.

Mars Hill; post settlement, Carleton county, N.B. (Not Mar's Hill.)

Martel; post office, Russell county, Ont. (Not Martel Corners.)

Martel Corners. See Martel.

Marten; creek, tributary to Michel creek, Kootenay district, B.C. (Not Martin.)

Marten; river, tributary to Rupert river, Mistassini territory, Que.

Marten Drinking; river, emptying into Attawapiskat lake, Patricia district, Ont.

Martimoki; lake, Saguenay county, Que. (Not Martimokinipau.)

Martin; head, St. Martins parish, St. John county, N.B. (Not Martin's nor St. Martin.)

Martin. lake, northeast of Lost lake, Kenora district, Ont.

Martin; lake, southeast of Humboldt bay, L. Nipigon, Thunder Bay district, Ont.

Martin; mountain, east of Lesser Slave lake, Alberta.

Martin. See Martre.

Martineau; bay, Lorrain township, Timiskaming district, Ont.

Martineau; river, flowing southwesterly into Cold lake, central Alberta.

Martini; island, west of Moore point, southern coast of Digby I., Coast district, B.C.

Martins; valley, east of Chancellor peak, Rocky mountains, Kootenay district, B.C.

Martre (rivière à la); river, Christie township, Gaspe county, Que. (Not Martin river nor Rivière à la Marte.)

Mary; creek, tributary to Teslin river, near M'Clintock peak, Yukon.

Mary; point, Boxer reach, Coast district, B.C.

Mary; shoal, south of Great Duck island, Manitoulin district, Ont.

Mary. See Marina.

Marysville (village). See Wolfe Island (village).

Mary Vaux; mount, south of southeast end of Maligne lake, Rocky mountains, western Alberta.

Mascabin; point, N. entrance Passamaquoddy B., Charlotte Co., N.B. (Not Mascarin.)

Mascareen; peninsula and village, Charlotte, N.B. (Not Mascarene nor Mascarren.)

Mascarin. See Mascabin.

Mashamengoose. See Mitchinamekus.

Masinabik; lake, S.E. of L. Nipigon, Thunder Bay dist., Ont. (Not Masinabikaigan.)

Maskwa; hill, on Battle river, west of Cutknife creek, central Saskatchewan.

Maskwa; river, tributary to Winnipeg river, Man. (Not Bear.)

Maspeck. See Mispeck.

Massasauga; point, west of Horse point, Ameliasburg Tp., Prince Edward Co., Ont.

Masstown; lightstation, fishing and post settlement, Cobequid bay, Colchester county, N.S. (Not Debert nor Mass Town.)

Matabechawan. See Matabitchuan.

Matabitchuan; river, flowing into lake Timiskaming, below the mouth of Montreal river, Timiskaming district, Ont. (Not Matabechawan nor Matabitchouan.)

Matamik. See Lois.

Matapedia; lake, river and village, Matane and Bonaventure Cos., Q. (Not Metapedia.)

Matashi; river, headwaters of Gatineau river, Berthier county, Que.

Matawa. See Mattawin.

Matawa. See Shamattawa.

Matawin. See Mattawin.

Matchimanito; lake, southwest of Millie lake, Pontiac county, Que.

Matheson; island, W. of N. entrance to narrows of lake Winnipeg, Man. (Not Snake.)

Matheson; mount, also lake, north of Becher bay, Vancouver island, B.C.

Matheson; mount, on east side of Bennett lake, Yukon.

Matilda; lake, Redditt township, Kenora district, Ont.

Matinatinda. See Tendinenda.

Matsatu; river, tributary to Nahlin river, Cassiar district, B.C.

Mattagami; lake, Abitibi territory, Que.

Mattagami; river, tributary to Moose river, Timiskaming district, Ont. (Not South Branch of Moose river.)

Mattagami. See Allard.

Mattawagosik. See Dasserat.

Mattawin; river, tributary to St. Maurice river, Berthier, Champlain, Joliette, Maskinongé, and St. Maurice counties, Que. (Not Matawa nor Matawin.)

Matthew; creek, tributary to St. Mary river, Kootenay district, B.C.

Matthews; point, Active pass, strait of Georgia, New Westminster district, B.C.

Mattice; lake, south of N.T. Ry., northwest of L. Nipigon, Thunder Bay district, Ont.

Mauger; beach, at entrance to Halifax harbour, Halifax county, N.S. (Not Meagher.)

Maunoir; butte, near confluence of Lewes and Teslin rivers, Yukon.

Maurelle; island, between "Hole in the wall" and Surge narrows, Coast district, B.C. The eastern portion of what was formerly Valdes island.

Maus; creek, E. of Kootenay R., south of Steele, Kootenay district, B.C. (Not Mouse.)

Maxwell; mount, Saltspring island, S.E. coast of Vancouver I., B.C. (Not Baynes.)

Maybank; post office, Huntingdon county, Que. (Not May Bank.)

Maybee. See Mabee.

Mayes; point, at N. end of Read I., Sutil channel, Coast district, B.C. (Not Mayor.)

Mayflower; island, at entrance to Thomas bay, Manitoulin island, Ont.

Maynard; lake, English river, Kenora district, Ont. (Not Maynard's.)

Mayne; island and post village, strait of Georgia, New Westminster district, B.C.

Mayo; brook and lake, tributary to Stewart river, Yukon.

Mayor. See Mayes.

Mazokama. See Kama.

Meacham; creek, St. Mary river, Kootenay, B.C. (Not Caribou nor Whitefish.)

Meadow; creek, branch of Sulphur creek, Indian river, Yukon.

Meadow; creek and lake, tributary to Beaver river, central Saskatchewan.

Meadow. See Hawkins.

Meadow. See Linklater.

Meagher. See Mauger.

Meander; brook, south of Eagle lake, Kenora district, Ont.

Mecatina. See Mekattina.

Medicine; river, tributary to Red Deer river, southern Alberta.

Medicine-lodge; hills, in Tp. 40, R. 2, W. 3 M., southern Alta. (Not Medicine Lodge.)

Medicine Lodge. See Lodge.

Medicine-stone; lake, south of Red lake, Patricia, Ont. (Not Medicine Stone.)

Meduxnekeag; river, tributary to St. John river, Carleton county, N.B. (Not Maduxnakeag nor Meduxnakeag.)

Medway; river, trib. to N. branch of Thames R., Middlesex Co., Ont. (Not Arva creek.)

Medway; seaport town, Queens county, N.S. (Not Port Medway nor Port Metway.)

Meehin; brook, flowing into Minas channel, Kings county, N.S. (Not Meehins.)

Meeting; lake, in the Thickwood hills, central Saskatchewan.

Megantic; county, lake, and village, Que. (Not Lake Megantic village.)

Meggisi; brook, tributary to upper Winisk R., below Tabasokwia R., Patricia, Ont.

Meggisi; lake, east of Manitou lake, Kenora district, Ont. (Not Small Trout.)

Megiskun. See Migiskan.

Mehollan. See Mulholland.

Meholland. See Mulholland.

Meig; post office, Missisquoi county, Que. (Not Meig's Corners.)

Meig's Corners. See Meig.

Meisner; point, E. side Mahone bay, Lunenburg Co., N.S. (Not Meisener nor Misener.)

Mejomanguse. See Mitchinamekus.

Mekamic. See Makamik.

Mekattina; cape, islands, and river, Saguenay county, Que. (Not Mecatina, nor Little Mecattina river.)

Mekinak; lake, river, and township, Champlain county, Que. (Not Mekinac.)

Mekiscan. See Migiskan.

Meldrum; point, northwestern end of Manitoulin island, Manitoulin district, Ont. (Not Mildram nor Mildrum.)

Melfort; creek, railway station, and settlement, central Sask. (Not Stony creek.)

Melon; lake, between Knife and Carp lakes, Int. boundary, Rainy River district, Ont.

Melville; arm, on northerly side of Prince Rupert harbour, Coast district, B.C.

Melville; island, Admiralty group, St. Lawrence river, Leeds county, Ont. (Not Hay.)

Melville; lake, expansion of Hamilton inlet, Ashuanipi, Que. (Not Groswater bay.)

Melville; point, south of Srigley bay, Manitoulin district, Ont.

Melville; shoal, E. of N.E. end of Amherst I., Frontenac Co., Ont. (Not Seven Acre.)

Menadou. See Mainadieu.

Menan. See Grand Manan.

Mendenhall; river, tributary to Takhini river, Yukon.

Menesatung; park, north of Goderich, Huron county, Ont.

Menikwesi; lake, west of Kawawia lake, Kenora district, Ont.

Menjobaguse. See Mitchinamekus.

Mennin; lake, S.E. of Dinorwic L., Kenora district, Ont. (Not Blueberry nor Shallow.)

Meogenes. See Manawagonish.

Merigomish; island and village, Pictou Co., N.S. (Not Big I. nor Merigomishe village)

Merion. See Mirond.

Merlin; lake, north of mount Richardson, Rocky mountains, Alberta.

Mermaid; island, Admiralty group, St. Lawrence R., Leeds county, Ont. (Not Pine.)

Merriam; bay, west of Bayley bay, Basswood L., Int. boundary, Rainy R. district, Ont.

Merrill. See Fréchette.

Mescoh. See Misko.

Meskwatessi; lake, east of Atikwa lake, Kenora district, Ont.

Mestowana; lake, northwest of Lost lake, Kenora district, Ont.

Metabetchouan; post office, river, and township, Chicoutimi county, Que. (Not Metabechouan.)

Metaghan. See Meteghan.

Metapedia. See Matapedia.

Metchiskan. See Migiskan.

Metchosin; mountain, west of Parry bay, Vancouver I., B.C. (Not Metchosin hill.)

Meteghan; river and village, Digby county, N.S. (Not Metaghan.)

Meteghan Station; post office, Digby county, N.S. (Not Metaghan.)

Metford; island, midway between Lima and Miller points, southern coast of Digby island, Coast district, B.C.

Methuen; reef, south shore Manitoulin island, Manitoulin district, Ont.

Methy; lake, south of File lake, Manitoba. (Not Long.)

Methye; lake, portage, and river, northern Sask. (Not La Loche nor Methy.)

Metis; lake, point, river, and village, Matane Co., Que. (Not Mitis nor Great Metis.)

Metiscan. See Migiskan.

Metlakatla; bay and village, Chatham sound, Coast district, B.C. (Not Melta Catla, Metla Catlah, Metlah Catlah, Metla-kathla, Methlakahtla, nor Metla-Katla.

Meule (pointe à la): point with 2 range lights thereon, west shore of Richelieu river, St. John county, Que. (Not North of Halfway nor Pointe à la Mule.)

Michael; bay and point, south shore of Manitoulin island, Manitoulin district, Ont.

Michael; lake, northwest of Kulleet bay, Vancouver island, B.C.

Michael; peak, President range, Rocky Mts., Kootenay district, B.C. (Not Michael's.)

Michagama. See Kitchigama.

Michaud; creek, tributary to Klondike river, Yukon.

Michaud; creek, west of Lower Arrow lake, Kootenay district, B.C.

Michel; creek, tributary to Elk river, Kootenay district, B.C.

Michepasque. See Mispek.

Michie; mount, east of lake Marsh, Yukon.

Michikamog; lake, northeast of Attawapiskat lake, Patricia district, Ont.

Michikenis; river, east of Wunnummin lake, upper waters of Winisk R., Patricia, Ont.

Michikenopik; brook, tributary to Pizustigwan river, upper Winisk R., Patricia, Ont.

Michipicoten; harbour, island, river, and village, Manitoulin district, Ont. (Not Michipicoton.)

Middle; creek, tributary to Tahltan river, Cassiar district, B.C.

Middle Fork of Gold creek. See Caven creek.

Middle; mountain, near lower Stikine R., S. of Porcupine creek, Cassiar dist., B.C.

Middle; river, Pictou county, N.S. (Not Middle river of Pictou.)

Middle Branch of Highwood river. See Pekisko creek.

Middle Branch of West river. See Dalesville river.

Middlebrun; bay, channel, and island, S. entrance to Black B., Thunder Bay dist., Ont.

Middle Caledonia. See Caledonia.

Middle Duck; island, south of Inner Duck island, Manitoulin district, Ont.

Middleport. See Tuscarora.

Middle Savage; islands, northwest of Pritzler harbour, Hudson strait, N.W.T. (Not islands of God's Mercie (eastern).

Middleton; island, at the mouth of Broadback river, Abitibi territory, Que.

Middleton; mount, southeast of lake Evans, Abitibi territory, Que.

Middletons. See Reesor.

Midjik; point, on east side of Passamaquoddy bay, Charlotte county, N.B. (Not Midgic, Midjic, nor Mijic bluff.)

Midnight; lake, Tp. 52, R. 16, W. 3 M., Saskatchewan.

Midway; mining town and railway station, Similkameen district, B.C.

Migiskan; river, flowing westerly from the height of land near sources of St. Maurice river into Shabogama lake, Pontiac county, Que. (Not Megiskun, Mekiscan, Metchiskan, nor Metiscan.)

Migoacha. See Maguasha.

Miguasha. See Maguasha.

Mijic. See Midjik.

Mikwasach; lake, west of Opemiska lake, Abitibi territory, Que. (Not Wikwasash.)

Mildram. See Meldrum.

Mildrum. See Meldrum.

Mile; island, Brock group, St. Lawrence R. Leeds county, Ont. (Not Huckleberry.)

Mile. See Victoria.

Miles; canyon, on Lewes river, above Whitehorse rapid, Yukon.

Miles; point, Gabriola island, strait of Georgia, B.C. (Not Schooner.)

Milk; river, rises in Montana, and crossing the international boundary flows easterly through Alberta, thence southwesterly, recrossing the boundary, into Montana.

Mill. See Galt.

Millar; settlement, Grenville county, Ont. (Not Millar's Corners.)

Millar's. See Riall.

Millar's Corners. See Millar.

Miller; creek, tributary to Sixtymile river, Yukon.

Miller; lake, southwest of Williams bay, L. Seul, Kenora district, Ont.

Miller; mount, west of Lewes river, Yukon.

Miller; point, western entrance point of Robinson cove, Big island, bay of Quinte, Prince Edward county, Ont. (Not Miller's.)

Miller; point, southeast coast of Digby island, Coast district, B.C.

Mille-Roches; post village, Stormont county, Ont.

Mille-Vaches; bay, point, and river, Saguenay Co., Que. (Not Saut de Mouton river.)

Millie; lake, northeast of Matchimanito lake, Pontiac county, Que.

Milliken; post village and railway station, Markham township, York county, Ont. (Not Millikens.)

Millstream; river, flowing easterly into Nipisiguit bay, Gloucester county, N.B. (Not Little Nipisiguit nor Nipisiguit Millstream.)

Milton; bank, southeast of Wells shoal, Bruce county, Ont.

Milton; island, N. of Wolfe I., St. Lawrence R., Frontenac Co., Ont. (Not Amazon.)

Milton; mount, east of Lewes river, Yukon.

Milton; point, between Lonely and Lougheed bays, Manitoulin island, Ont.

Milton; post office, Shefford county, Que. (Not Milton East.)

Milton; town and railway station, Halton county, Ont. (Not Milton West.)

Miltonbrae; post office, Gloucester county, N.B. (Not Milton Brae.)

Milton East. See Milton.

Milton West. See Milton.

Miminegash; river and village, Prince county, Prince Edward Island. (Not Big or North Miminigash, nor Minimegash.)

Miminiska; lake, Albany river, Patricia and Thunder Bay districts, Ont.

Mimominatik; brook, emptying into Kapkichi lake, upper Winisk R., Patricia, Ont.

Minago; river, emptying into Cross lake, Manitoba. (Not Pine.)

Minaret; col. and peak, Sir Sandford range, Selkirk Mts., Kootenay district, B.C.

Minas; basin, east arm of the bay of Fundy, Colchester, Cumberland, Hants, and Kings counties, N.S. (Not Basin of Mines nor Mines Basin.)

Mindemoya; river, emptying into Providence bay, Manitoulin I., Manitoulin dist., Ont.

Mineral; creek and town, north of Caribou creek, Kootenay district, B.C.

Mineronte. See Mirond.

Miners; range of mountains, near lake Laberge, Yukon.

Mines basin. See Minas basin.

Minette; bay, Kitimat arm, Coast district, B.C.

Minimegash. See Miminegash.

Minimegash. See Roseville.

Ministik; lake, in Tp. 50, R. 21, W. 4th M., Alberta.

Ministikwan; lake, west of Makwa lake, central Sask. (Not Little Island lake.)

Minitonas; creek, hill, post office, and railway station, western Manitoba.

Mink; reef, Manitoulin island, northwest of Steevens island, Manitoulin district, Ont

Mink. See Ninette.

Minnaweiskag; lake, N. Manitou L., Kenora dist., Ont. (Not Kaminnaweiskagwok.)

Minnedosa; river, tributary to Assiniboine river, western Manitoba (Not Little Saskatchewan nor Rapid.)

Minnehaha; lake, north of Peak lake, Kenora district, Ont. (Not Kiskopkechewans.)

Minnesabik; lake, south of Separation lake, Kenora district, Ont.

Minnewakan; post village, Posen municipality, Manitoba.

Minnewanka; lake, in the Rocky Mountains park, Alberta. (Not Devil's Head.)

Minnie Bell; creek, tributary to Flat creek, Klondike river, Yukon.

Minnikau; river, east of Minnitaki lake, Kenora district, Ont.

Minnitaki; lake and railway station, Kenora district, Ont. (Not Minnietakie.)

Mint; creek, branch of Hunker creek, Klondike river, Yukon.

Minto; mount, west of Atlin lake, near north end, Cassiar district, B.C.

Miquelon; lake, in Tp. 49, Rs. 20 and 21, W. 4th M., Alberta.

Miramichi; bay and river, Northumberland county, N.B. (Not Mirimichi.)

Mire. See Shunda.

Mirimichi. See Miramichi.

Miron; lake, headwaters of Sturgeon-weir river, eastern Saskatchewan. (Not Heron, Merion, Mineronte, nor Stone.)

Mirror; lake, west of lake Louise, Alberta.

Misamikwash; lake, west of Wunnummin lake, upper waters of Winisk river, Patricia district, Ont.

Miscou; island, harbour, point, Gloucester Co., N.B. (Not Miscow, Mya, nor N. Mya.)

Misener. See Meisner.

Misery; bay and point, south shore Manitoulin island, Manitoulin district, Ont.

Mishagomish; lake, east of lake Evans, Abitibi territory, Que.

Mishomis; lake, southwest of Grand lake Victoria, Timiskaming county, Que.

Misinabi. See Missinaibi.

Miskatla; Indian village, Douglas channel, opposite Maitland island, Coast district, B.C. (Not Mis-ka-tla.)

Miskittenau; lake, at headwaters of Rupert river, Mistassini territory, Que.

Misko; creek, tributary to Ottertail R., Rocky Mts., Kootenay dist., B.C. (Not Mescoh.)

Miskwabi; lake, Dudley township, Haliburton county, Ont. (Not Mis-quah-be- nish.)

Mispec. See Mispek.

Mispeck. See Mispek.

Mispek; post settlement and river, St. John county, N.B. (Not Maspeck, Michepasque, Mispec, Mispeck, Misshapec nor Mizpeck.) Jeffery's map of 1755 has 'Mispek.'

Mis-quah-be-nish. See Miskwabi.

Missaguash; river, emptying into Cumberland bay, Westmorland county, N.B. (Not Misseguash, Missiguash, nor Missiquash.)

Missanabie. See Missinaibi.

Missawawi; lake, south of L. LaBiche, central Alberta. (Not Big Egg.)

Misseguash. See Missaguash.

Misshapec. See Mispek.

Missiguash. See Missaguash.

Missinaibi; lake and railway station, Algoma district, also river flowing from the lake into Moose river, Algoma and Timiskaming districts, Ont. (Not Misinabi nor Missanabie.)

Missinnippi. See Churchill

Mission; bay, and channel (southern) of Kaministikwia river, Thunder Bay district, Ont. (Not Mission river.)

Mission; mountain, Tsimpsean peninsula, W. of Prince Rupert har., Coast dist., B.C.

Mission; pass, between Bridge river and Seton lake, Lillooet district, B.C.

Missipisew; river, tributary to Grass river, Manitoba.

Missiquash. See Missaguash.

Mississagi; bay, island, river, and strait, at north end of lake Huron, Algoma and Manitoulin districts, Ont. (Not Mississauga.)

Mississagua; brook and lake, Peterborough county, Ont. (Not Gull lake.)

Mist: creek and mountain, Misty range, southern Alberta.

Mista; a peak of the Valkyr mountains, Kootenay district, B.C.

Mistake; mountain, northwest of L. Laberge, Yukon.

Mistassibi; river, tributary to Mistassini river, Lake St. John county, Que. (Not Muskosibi.) Reversal of previous decision.

Mistassini; lake, Mistassini territory, Que.

Mistassinis. See Albanel.

Mistawak; lake, W. of Harricanaw R., Abitibi, Que. (Not Mistewak nor Mistowak.)

Mistaya; river, at headwaters of Saskatchewan river, Alta. (Not Little Fork of the Saskatchewan nor Bear creek.)

Mistigouche. See Mistikus.

Mistigougèche. See Mistikus.

Mistikus; lake, Rimouski county, Que. (Not Mistigouche nor Mistigougèche.)

Misty; range of mountains, northwest of Highwood range, southern Alberta.

Mitchell; bay and point, L. St. Clair, Kent county, Ont. (Not Mitchell's.)

Mitchell Bay; post village, Kent county, Ont. (Not Mitchell's Bay.)

Mitchell; range of mountains, east of Kootenay river, Kootenay district, B.C.

Mitchinamekus; lake and river, headwaters of Lièvre river, Berthier, Champlain, Maskinonge, and St. Maurice counties, Que. (Not Mashamengoose, Mejomanguse, nor Menjobaguse.)

Mitis. See Metis.

Mitishto; river, tributary to Grass river, below Wekusko lake, Manitoba.

Mizpeck. See Mispek.

Moberly; creek, west of Lower Arrow lake, Kootenay district, B.C.

Moberly; lake and river, tributary to Peace R., Cariboo, B.C. (Not Moberley.)

Moberly; mount, east of Athabaska river, 17 miles above mouth of Whirlpool river, western Alberta.

Moberly; peak, and railway station, Rocky mountains, Kootenay district, B.C.

Mohawk; post settlement and railway station, Brant Co., Ont. (Not Mt. Pleasant.)

Moira; river, emptying into the bay of Quinte, near Belleville, Hastings county, Ont.

Moisie; bay, point, river, rock, and shoal, Saguenay Co., Que. (Not Moisi nor Moisic.)

Mokowan; butte, east of Belly river, southern Alberta. (Not Belly.)

Mokwawastuk; lake, at headwaters of Marten river, Mistassini territory, Que. (Not Mokwahwastuk.)

Molar; mountain, northeast of mount Hector, Rocky mountains, Alberta.

Molesworth. See Lois.

Moloch; mount, southeast of Mt. Holway, Selkirk Mts., Kootenay district, B.C.

Molus; river, tributary to Richibucto river, Kent county, N.B. (Not Moulie's.)

Momozekel. See Mamozekel.

Monckland; post village and railway station, Stormont county, Ont. (Not Moncklands, Monklands, nor Moncklands Station P.O.)

Mondonak; lake and river, upper waters of Manuan river, Champlain county, Que.

Monell; reef, at entrance to Wood bay, Manitoulin island, Manitoulin district, Ont.

Money; point, on the southerly portion of Hawkesbury island, Coast district, B.C.

Mongus; lake, near Manitou lake, Kenora district, Ont.

Monk; lake, Cardiff township, Haliburton county, Ont.

Monklands. See Monckland.

Monmouth; lake, Monmouth township, Haliburton county, Ont.

Monquart; river, tributary to St. John river, Carleton county, N.B. (Not Manquart nor Munquart.)

Monroe; creek and lake, near Moyie lake, Kootenay district, B.C.

Monson; mount, west of Lewes river, Yukon.

Montague; lake, Tp. 6, R. 29, W. 2 M., Saskatchewan.

Montê; creek, hills, and lake, south of Ducks station, Kamloops district, B.C.

Monts (pointe des); point, Saguenay county, Que. See also Pointe-des-Monts.

Monsomshi; lake, on Severn river, Patricia, Ont. (Not Mon-som-shi-pin-net.)

Montague; lake, Skead township, Timiskaming district, Ont.

Montague; village, Kings county, Prince Edward Island. (Not Montague Bridge.)

Montana; creek, tributary to Yukon river, above Dawson, Yukon.

Montebello; railway station and village, Ottawa county, Que. (Not Monte Bello.)

Montée-du-Lac; cove and landing, on the St. Lawrence, west of Cap Brulé, also road leading from thence to St. Joachim lakes, Montmorency county, Que.

Montée du Lac. See Cap Brulé.

Montgomery. See McCoy.

Montgomery. See Young.

Mont-Laurier; parish, post office, and railway station, Labelle county, Que. (Not Mont Laurier.)

Montreal; channel, west of Edward island and south of entrance to Black bay, Thunder Bay district, Ont.

Montreal; lake and river, south of Churchill river, central Sask. (Not Rapid river.)

Montreal; river, flowing southeasterly into lake Timiskaming, Ont.

Montrose; cape, Markham bay, Hudson strait, N.W.T.

Monumental; island, southeast of Clements Land, N.W.T.

Moody; point, Boxer reach, Coast district, B.C.

Moonshine. See Uphill.

Moore; lake, Lutterworth township, Haliburton county, Ont. (Not Moore's.)

Moore; point, southerly coast of Digby island, Coast district, B.C.

Moore; post village, Lambton county, Ont. (Not Mooretown.)

Moore; rock, Blunden harbour, Queen Charlotte sound, Coast district, B.C.

Moose; creek, tributary to Fortymile river, near international boundary, Yukon.

Moose; island, Fisher bay, lake Winnipeg, Manitoba.

Moose; lake, north of Cedar lake, Manitoba.

Moose; lake and portage, on international boundary, Thunder Bay district, Ont.

Moose; mountain, also Moose Mountain creek and post office, southeastern Sask.

Moose. See Bonald.

Moose. See Fawcett.

Moosehide; creek and mountains, near mouth of Klondike river, Yukon.

Moosehorn; bay and lakes, east shore of L. Manitoba, Man. (Not Moose Horn.)

Moosehorn; lake, west of Grand lake Victoria, Timiskaming county, Que.

Moosejaw; creek and city, Sask. (Not Moose Jaw.)

Mooshaulagan. See Mushalagan.

Mooyie. See Moyie.

Moraine; lake, south of mount Temple, Alberta.

Moran. See Moras.

Moras; island, at mouth of Nicolet river, Nicolet county, Que. (Not Moran.)

Moreau; islet, southern of 3 rocky islets in the St. Lawrence, off St. Germain, Kamouraska county, Que .

Morgan; lake, south of Silver lake, Kenora district, Ont.

Morice; lake and river, tributary to Bulkley river, Coast district, B.C. (Not Morrice.)

Moricetown; village, on Bulkley river, Coast district, B.C. (Not Morricetown.)

Morien; bay and cape, in the northeasterly portion of Cape Breton county, N.S. (Not Cow nor Murgin.)

Morien Bay (village). See Port Morien.

Morin; creek, flowing northeasterly into Meadow creek, central Sask. (Not Bear.)

Morin; shoal, centre of channel about 8 miles above Hare island, St. Lawrence river, Que.

Morley; river, emptying into Teslin lake, Yukon.

Morrice. See Morice.

Morricetown. See Moricetown.

Morris; lake, Tp. 17, R. 1, E. P.M., Manitoba. (Not Norris.)

Morris; river, tributary to Red river, Man. (Not Boyne, Ile de Bois nor Scratching.)

Morris; town, in southern Manitoba.

Morrison; mount, on Yukon river, near international boundary, Yukon.

Morrissey; town, creek, and ridge, south of Fernie, Kootenay district, B.C.

Morse; basin, east of Kaien island, Coast district, B.C.

Morse; creek, Prince Rupert, Coast district, B.C.

Morse; mount, south of Tuck inlet, Coast district, B.C.

Moresby; island and passage, in the north end of Haro strait, B.C.

Moses Oates; cape, Charles island, Hudson strait, New Quebec.

Mosher; creek and ridge, west of Beaverhill creek, Similkameen district, B.C.

Mosher; island and point, E. side St. Margaret bay, Halifax Co., N.S. (Not Grampus.)

Mosquito; creek, tributary to Bonanza creek, Yukon.

Mosquito. See Arrowpark.

Mossy; river, flowing from Dauphin lake to lake Winnipegosis, Manitoba.

Mouat; channel and reef, off southeast point of Vancouver island, B.C. (Not Mouatt.)

Mouat; islands, off S.W. coast of Texada I., New Westminster dist., B.C. (Not Mouatt.)

Mouat; point, W. point of Pender I., New Westminster dist., B.C. (Not Mouatt.)

Mouat; rock, in Golletas channel, northern coast of Vancouver I., B.C. (Not Mouatt.)

Mouatt. See Mouat.

Mouchalagan. See Mushalagan.

Mouile. See Mouillée.

Mouille. See Mouillée.

Moulie's. See Molus.

Mouillée; point, in St. Lawrence R., Glengarry Co., Ont. (Not Mouile nor Mouille.)

Mountain; lake, southwest of lake Lindeman, Cassiar district, B.C. (Not Long lake.)

Mountain; lake on international boundary, Thunder bay district, Ont.

Mountain. See Cliff.

Mountain. See Liard.

Mountain. See Watchi.

Mount Johnson; post office and railway station, Iberville Co., Que. (Not St. Grégoire.)

Mt. Pleasant. See Mohawk.

Mourier; lake, Desroberts township, Timiskaming, Que. (Not Wikwaskapauk.)

Mouse. See Maus.

Mowat; mount, about three miles north of Grant Brook station G.T.P.R., Cariboo district, B.C.

Moyie; lake, river, and town, in S.W. portion of Kootenay dist., B.C. (Not Mooyie.)

Muchalat; arm, the eastern arm of Nootka sound, Vancouver island, B.C. (Not Guaquina.)

Muchalat; lake and river, headwaters of Gold river, Nootka district, Vancouver island, B.C.

Muchuya; creek, tributary to Kakuchuya river, Cassiar district, B.C.

Mud; glacier, northeast of mount Purity, Selkirk mountains, Kootenay district, B.C.

Mud. See Bayfield.

Mud. See Chilako.

Mud. See Gillies.

Mud. See Kabagukski.

Mud. See Kikomun.

Mud. See Mance.

Mud. See Rose.

Muddy. See Pikitigushi.

Muddy Water. See Apeganau.

Mudge; island, between Gabriola and Vancouver islands, B.C.

Mudie; lake, south of Beaver river and north of Ministikwan lake, central Sask.

Mudjatik; river, tributary to Churchill river, north of Ile à la Crosse, Sask. (Not Caribou nor Mudjatick.)

Muhigan; river, emptying into Sipiwesk lake, Man. (Not Wolf nor Wolf Rand.)

Muirkirk; railway station and village, Oxford Tp., Kent Co., O. (Not Muir Kirk.)

Muir; creek, flowing into Juan de Fuca strait, also mountain, Vancouver island, B.C.

Mukoman; river, tributary to Churchill river, Saskatchewan.

Mulcaster; island, Navy group, St. Lawrence river, Leeds county, Ont. (Not Sugar.)

Muldrew; lakes (2), west of Gravenhurst, Muskoka district, Ont. (Not Leg lake nor Rice lake.)

Mulholland; point, Campobello island, Charlotte county, N.B. (Not Mulholland's, Meholland, nor Mehollan.).

Mulvey; creek, tributary to Slocan river, Kootenay district, B.C.

Mumm; peak, north of Robson pass, Rocky mountains, Cariboo district, B.C.

Mummery; mountain, west of Blaeberry river, Rocky Mts., Kootenay district, B.C.

Munosahn. See Manasan.

Munquart. See Monquart.

Munro; creek, emptying into Gladys lake, Cassiar district, B.C.

Munro; mount, east of Atlin lake, Cassiar district, B.C.

Munro; point, St. Ann harbour, Victoria county, N.S. (Not Munroe nor Munro's.)

Munroe Mills; post office, Glengarry Co., Ont. (Not Munro's Mills nor Munroe's Mills.)

Murchison; cape, southeast end of Brevoort island, N.W.T.

Murchison; island, L. Nipigon, Thunder Bay district, Ont. (Not Murchison's.)

Murchison; mount, also icefield, east of Mistaya river, Rocky mountains, Alta.

Murgin. See Morien.

Muriel; lake, Tps. 59 and 60, R. 5, W. 4 M., eastern Alberta.

Murphy; harbour and point, south shore of Manitoulin I., Manitoulin district, Ont.

Murphy; lakes, north of Tulameen river, Yale district, B.C. (Not Eagle nor Fish.)

Murray Bay (Eng. usage), **Malbaie** (Fr. usage); village, Charlevoix county, Que. (Not Mal Bay, Malbay, nor Malbaye.)

Murray; canal, in Murray and Brighton townships, connecting the bay of Quinte with Presqu'ile bay, Northumberland county, Ont.

Murray; creek, tributary to Sutherland river, south of Lesser Slave lake, central Alta.

Murray; island, St. Lawrence river, below Brockville, Leeds county, Ont.

Murray; island, Cold lake, central Alberta and Saskatchewan.

Murray; lake, east of Jackfish lake, central Saskatchewan.

Murray; point, Markham bay, Hudson strait, N.W.T.

Murray; reef, southwest of Dead island, also rocks south of Dead island, at entrance to Key harbour, Georgian bay, Parry Sound district, Ont.

Murray; river, tributary to the St. Lawrence, Charlevoix county, Que. French usage: Malbaie (rivière), which see.

Murtle; lake and river, tributary to Clearwater river, Kamloops district, B.C. (Not Myrtle.)

Muscote; bay, off Big bay, S.W. side of the bay of Quinte, Prince Edward Co., Ont.

Mushalagan; lake, Saguenay county, Que. (Not Mooshaulagan nor Mouchalagan.)

Mushonga. See Pemichangan.

Muskiki; lake, north of Dana, Saskatchewan. (Not Houghton.)

Muskoka; lake and river, Muskoka district, Ont.

Muskosibi. See Mistassibi.

Muskrat. See Manigotagan.

Muskwaro; point and river, Saguenay county, Que. (Not Musquarro.)

Muskwesi; river, flowing into north end of Southern Indian lake, Sask.

Mussen; mount, near southern end of Atlin lake, Cassiar district, B.C.

Mutchmore; point, south shore Manitoulin island, Manitoulin district, Ont.

Mya; point, Shippigan island, Gloucester county, N.B. (Not South Mya.)

Mya. See Miscou.

Myers; island, southwest of Lynedoch island, St. Lawrence river, Leeds county, Ont.

Myers; point, Sidney township, Hastings county, Ont.

Myles; shoal, opposite Kingston, Frontenac county, Ont. (Not Royal George.)

Myra; cove and island, Blind bay, Halifax county, N.S. (Not Myra's.)

Myrtle. See Murtle.

Mystery; lake, southwest of Cliff lake, Kenora district, Ont.

N

Na-a-ma. See Nemaia.

Naas. See Nass.

Nabesipi. See Nabisipi.

Nabesippi. See Nabisipi.

Nabisipi; river, north shore gulf of St. Lawrence, Saguenay county, Que. (Not Nabesipi nor Nabesippi.)

Nacawicac. See Nackawic.

Nackawic; river and village, York county, N.B. (Not Nacawicac nor Nackawick.)

Nadahini; river, tributary to Chilkat river, Cassiar district, B.C.

Nadina; mountain, and river flowing into Francois lake from the west, Coast district, B.C. (Not Nadinaka river nor Nadinako river.)

Nahlin; river, tributary to Inklin river, Cassair district, B.C.

Nahoni; mountains, also lakes (upper, lower and middle), at headwaters of Porcupine river, Yukon. (Not Nahone.)

Nainlin; brook, tributary to lower Gravel river, Mackenzie, N.W.T.

Najan; river, tributary to St. Maurice river, above Manuan river, Champlain Co., Que.

Najualand. See Najwalwank.

Najwalwank; lake, Quebec county, Que. (Not Kajoualwang nor Najualand.)

Nakimu; caves, in valley of Cougar creek, Selkirk mountains, Kootenay district, B.C.

Nakina; river, tributary to Taku river, Cassiar district, B.C.

Nakonake; river, tributary to Sloko river, Cassiar district, B.C.

Nakusp; creek, railway terminus, and town, east side of Upper Arrow lake, Kootenay district, B.C. (Not Na-Kusp.)

Nalta. See Fraser

Naltesby; lake, on telegraph trail, N. of Chilako R., Cariboo dist., B.C. (Not Bobtail.)

Namaka; lake, post office, and railway station, southern Alberta.

Namakan; lake, S.E. of Rainy L. Int. boundary, Rainy R. dist., Ont. (Not Nameukan.)

Namawash; lake, upper Ottawa R., N.W. of Grand L. Victoria, Timiskaming, Que.

Namego; lake, south of Separation lake, Kenora district, Ont.

Namegos; lake, south of Matchimanito lake, Montcalm Co., Que. (Not Nemegos.)

Namegosis; lake, south of Matchimanito lake, Montcalm Co., Que. (Not Nemegosis.)

Nameiben; lake, north of Kagianagami lake, Thunder Bay district, Ont.

Nameins; rapids, upper Winisk river, Patricia district, Ont.

Nameukan. See Namakan.

Namew; lake, northeast of Cumberland lake, Sask. (Not Sturgeon.)

Namiska. See Nemiskau.

Namoukan. See LaCroix.

Nanaimo; harbour, river, and town, Vancouver island, B.C.

Nankika; lake, northwest of Attawapiskat lake, Patricia district, Ont.

Nankivell; islands, Blunden harbour, Queen Charlotte sound, Coast district, B.C.

Nankivell; point in Nanoose harbour, east coast of Vancouver island, B.C.

Napetipi; river, north shore gulf of St. Lawrence, Saguenay county, Que.

Narchilla; brook, emptying into McPherson lake, Yukon.

Nares; lakes between Bennett and Tagish lakes, Yukon.

Nares; mount, east of north end of Bennett lake, Yukon.

Nares; point, Departure bay, east coast of Vancouver island, B.C. (Not Boulder.)

Narrow. See Bagot.

Narrow. See Wallace.

Nasoga; gulf, eastern side of Portland inlet, Coast district, B.C. (Not Nasoka.)

Nass; bay and river, north of Skeena river, Cassiar district, B.C. (Not Naas, Nasse, nor Naas harbour.)

Natashkwan; harbour, point, and river, Saguenay county, Que. (Not Englishman's nor Natashquan nor Little Natashquan harbour.)

Natchipotchi; lake, at head of Etchipotchi R., Abitibi, Que. (Not Natchipoishi.)

Nation. See Petite Nation.

Nation. See South Nation.

Natla; river, tributary to Gravel river, N.W.T.

Naufrage. See Refuge.

Naumulten; mountain, east of head of Lower Arrow lake, Kootenay district, B.C.

Nauyats; island, southeast shore Ungava bay, New Quebec.

Navy; group of islands, St. Lawrence river, below Gananoque, Leeds county, Ont.

Navy; island, Bedford basin, Halifax harbour, Halifax county, N.S. (Not Stephens nor Stevens.)

Nawapitechin. See Villemontel.

Neal. See Neil.

Neale; lake, northeast of Lloydminster, Saskatchewan.

Nechako; river, tributary to Fraser river, Cariboo and Coast districts, B.C. (Not Nechaco nor Nechacco.)

Nechigona; lake, at headwaters of Berens river, Patricia district, Ont. (Not Hair.)

Neck; point, north entrance to Hammond bay, S.E. coast of Vancouver island, B.C.

Nedluk; lake, west of Koksoak river, New Quebec.

Needle; mountain, between the "big bends" of Watson and Wheaton rivers, Yukon.

Needles Eye; island, Brock group, St. Lawrence river, Leeds county, Ont.

Negik; lake, south of Churchill river and east of Pelican narrows, Saskatchewan.

Negro; cape, the southeast extreme of Cape Negro island, Shelburne county, N.S.

Negro; harbour, Shelburne county, N.S.

Negro (island). See Cape Negro (island).

Neil; harbour, Cape Breton county, N.S. (Not Neal, Neals, nor Neil's.)

Neilson; island, southeast of Stone island, Clayoquot sound, Vancouver island, B.C.

Nelles; post office, Haldimand county, Ont. (Not Nelles Corners nor Nelles' Corner.)

Nelles Corners. See Nelles.

Nello; river, headwaters Klondike river, Yukon.

Nelly; point, on the northwest portion of Princess Royal island, Coast district, B.C.

Nelson; lake, on Churchill river, Manitoba.

Nelson; lake, west of Edgar lake, Cassiar district, B.C.

Nelson; mount, at head of Clearwater and Hammond creeks, west of Windermere lake, Kootenay district, B.C. (Not Hammond.)

Nelson; river, flowing from lake Winnipeg into Hudson bay, Manitoba The two channels by which it drains the lake are East channel and West channel. (Not East river and West river.)

Nelson. See Fort Nelson.

Nemaia; lake and valley, northeast of Chilko lake, Coast and Lillooet districts, B.C. (Not Na-a-ma.)

Nemegos. See Namegos.

Nemegosis. See Namegosis.

Nemei; river, tributary to Churchill R., below Reindeer R., Sask. (Not Sturgeon.)

Nemeiben; bay, lake, and river, L. LaRonge, Saskatchewan.

Nemeibennuk; lake, W. of Anzhekumming L., Kenora district, Ont. (Not Sucker.)

Nemeigusabins; lake, near the upper waters of Winisk river, Patricia, Ont.

Nemikachi; lake, near the upper waters of Lièvre river, Maskinongé county, Que. (Not Nemicachingue.)

Nemiskau; lake, expansion of Rupert river, Mistassini, Que. (Not Namiska.)

Nemo; creek, west of Slocan lake, Kootenay district, B.C.

Ne-na-tik-go. See Ninatigo.

Nepigon. See Nipigon.

Nepihjee. See Leaf.

Nepisiguit. See Nipisiguit.

Nepopekum; creek, tributary to Skagit river, Yale district, B.C.

Neptuak; mountain, northwest of Deltaform mountain, Rocky mountains, Alberta, and Kootenay, B.C.

Neptune Head; point, at entrance to Stupart bay, Hudson strait, New Quebec.

Nequaqon. See LaCroix.

Nesto. See Hippa.

Neston; lake, west of lake Devizes, Thunder Bay district, Ont .

Net; lake, Cassels and Strathy townships, Nipissing district, Ont.

Netley; creek and lake, south of lake Winnipeg, Man. (Not Nettly nor Nipuwin.)

Netley; island, Lake Fleet group, St. Lawrence river, Leeds county, Ont.

Net Setting. See Setting.

Neutral; hills, west of Sounding lake, southeastern Alberta.

Nevin; mount, west of Hendon river, Cassiar district, B.C. and Yukon.

Newagama; lake, southeast of Abitibi lake, Timiskaming county, Que.

Newburg; post village and Ry. station, Carleton Co., N.B. (Not Newburg Junction.)

Newburg Junction. See Newburg.

New Canaan; post office, Kings county, N.S. (Not Canaan.)

Newell; sound, southwest shore of Frobisher bay, N.W.T. (Not Kangerflung.)

New Galloway. See Galloway.

New Galway. See Galloway.

New Liskeard. See Liskeard.

Newman; peak, Tp. 3, R. 1, W. 5 M., southern Alberta. (Not Newman's.)

Newmarket; post village, York county, N.B. (Not New Market.)

New Richmond; lightstation, township, and village, Bonaventure county, Que. (Not Richmond.)

Newton; fiord, Frobisher bay, N.W.T. (Not Tornait.)

Newton. See Newtown.

Newtown; village, Kings county, N.B.

Newtown; village, Guysborough county, N.S. (Not Newton nor New Town.)

New Wiltshire. See Wiltshire.

New Zealand; creek, tributary to Indian river, Yukon.

Niagara; island, Lake Fleet group, St. Lawrence river, Leeds county, Ont.

Niagara. See Crossman.

Nibinamik; lake, southwest of Wapikopa lake, upper Winisk river, Patricia, Ont.

Niblock; mount, also pass, northeast of Popes peak, Alberta.

Nicholas; islets, northeast of Vansittart island, Queen Charlotte sound, Coast district, B.C. (Not Nicolas.)

Nickadow. See Nigadu.

Nicoamen; plateau and river, Kamloops district, B.C. (Not Nicomen.)

Nicol; lake, Lorrain township, Timiskaming district, Ont.

Nicola; lake, mountain, plateau, post office, railway station, valley, and river, Kamloops district, B.C. "Upper Nicola," applied to that portion of the river east of Nicola lake, to be dropped.

Nicolas. See Nicholas.

Nictau; village, at the forks of Tobique river, Victoria county, N.B.

Nictor; lake, headwaters of Tobique river, Restigouche county, N.B.

Nictor. See Tobique.

Niddery; islands, northeast of Lynedoch island, St. Lawrence river, Leeds county, Ont.

Nidhe; brook, tributary to Gravel river, above Ekwi river, N.W.T.

Nigadu; river and village, Gloucester Co., N.B. (Not Nickadow, Nigado nor Nigadoo.)

Niganishe. See Ingonish.

Nigei; island, near northwest end of Vancouver island, B.C. (Not Galiano.) To avoid duplication. See Galiano island, strait of Georgia.

Nigger; island, between Belleville and Trenton; Hastings county, Ont.

Nigger; narrows, bay of Quinte, Hastings county, Ont. (Not Nigger island narrows.)

Nikabau; lake and river, headwaters of Ashuapmuchuan river, Chicoutimi county, Que.

Nikanassin; range of mountains, extending from the upper end of Brulé lake on Athabaska river to the north branch of Brazeau river, Alberta.

Niles; mount, southeast of mount Balfour, Kootenay district, B.C.

Nimpkish; lake and river, in northwest portion of Vancouver island, B.C. (Not Karmutsen lake nor Kla-anch river.)

Nimrod; lake, southwest of Bakado lake, Kenora district, Ont.

Ninatigo; lake, Stanhope township, Haliburton county, Ont. (Not Ne-na-tik-go.)

Ninemile; point, also Ninemile Point lightstation, southwest end of Simcoe island, Frontenac county, Ont. (Not Gage.)

Ninette; island, Navy group, St. Lawrence river, Leeds county, Ont. (Not Mink.)

Niord; mountain, west of Slocan lake, Kootenay district, B.C.

Nipigon; bay, lake, river, and railway station, Thunder Bay district, Ont. (Not Nepigon nor Neepigon.)

Nipisiguit; lake and river, emptying into the bay of same name, Gloucester county, N.B. (Not Nepisiguit, Nipisiquit, nor Nipisghit.)

Nipisiguit Millstream. See Millstream river.

Nipmenanni; river, a tributary of Shoshokwan river, upper Ottawa, Pontiac county, Que. (Not Nipmenane.)

Nipple; mountain, east of Frances lake, Yukon.

Nipukatasi; river, emptying into Kenoniska lake, southeast of lake Evans, Abitibi, territory, Que. (Not Nipukatase.)

Nipuwin. See Netley.

Nisconlith. See Niskonlith.

Niskainlith. See Niskonlith.

Niskitogisew. See Kiskittogisu.

Niskonlith; Indian reserve, lake, and river, southwest of Little Shuswap lake, Kamloops district, B.C. (Not Nisconlith nor Niskainlith.)

Nisling; river, tributary to White river, east of Wellesley lake, Yukon. (Not Tahte.)

Nistowasis. See Threepoint.

Nisutlin; river, emptying into Teslin lake, Yukon.

Nith; river, flowing into Grand river, Brant, Oxford and Waterloo counties, Ont. (Not Smith's creek.)

Niut; range of mountains, on the western side of Tatlayoko lake, Coast district, B.C.

Nixon. See Towincut.

Noddawai. See Nottaway.

Nodway. See Nottaway.

Noel; harbour, Crooks inlet, Hudson strait, N.W.T.

Noel. See Nowell.

Nogold; creek, tributary to Stewart river, Yukon.

Nohomin; creek and Indian reserve, near Lytton, Kamloops and Yale districts, B.C. (Not No-ho-meen.)

Noire (rivière); river, flowing into the St. Lawrence below St. Siméon, Charlevoix Co., Que.

Noix (île aux); island, Richelieu river, St. Johns county, Que. (Not Fort Lennox.)

Nolin; island, at junction of Attawapiskat and Boulder rivers, Patricia, Ont.

Nomining; lake, post office, and railway station, Ottawa Co., Que. (Not Nominingue.)

Nonwatin; lake and river, tributary to Black Sturgeon river, south of L. Nipigon, Thunder Bay district, Ont. (Not Nonwatan.)

Nonwatinose; lake, on Black Sturgeon R., S. of L. Nipigon, Thunder B. district, Ont.

Noolki. See Nulki.

Noores. See Bath.

Norbury; lakes (2), east of Fenwicks station, Kootenay district, B.C. (Not Fish|)

Nordegg; river, tributary to Brazeau river, central Alberta. (Not Little Brazeau.)

Nordenskiöld; river, tributary to Lewes river, Yukon.

Norns; mountains, southeast of Airy mountain, Kootenay district, B.C.

Norquay; mount, northwest of Banff, Alberta.

Norris. See Morris.

Norse; lake, north of Rosamond lake, Kenora district, Ont. (Not Nurse.)

North; bay, north shore of Hudson strait, N.W.T.

North; channel, between Manitoulin I. and N. shore of L. Huron, Manitoulin dist., Ont.

North; lake, on international boundary, Thunder Bay district, Ont.

North; lake, Harburn township, Haliburton county, Ont.

North See Gladys.

North. See Hall.

North. See Langara.

North. See Old Factory.

North Albert; peak, northwest of Albert peak, Selkirk Mts. Kootenay district, B.C.

North Antler. See Gainsborough.

North Corner. See Norths.

North Cornwall. See Cornwall.

North Devon. See Devon.

North Duck; river, flowing easterly and northerly to Duck bay, lake Winnipegosis, Man. (Not Duck River North.)

North Branch (Kicking Horse river). See Amiskwi river.

Northeast; bay, Shabogama lake, Abitibi territory, Que.

Northfield. See Hennigar.

North Foreland. See Long.

North Foreland. See Queen Elizabeth.

North Fork; pass, west of Gould Dome mountain, Alta. and Kootenay district, B.C.

North Fork. See Yoho.

North Fork (Michel creek). See Alexander creek.

North Fowl; lake, on international boundary, Thunder Bay district, Ont. (Not Hen.)

North Head; harbour, port of entry, and village, on northern portion of Grand Manan island, Charlotte county, N.B. (Not Flag, Flag's or Flagg's cove, Grand Manan harbour, nor North Road village.)

North Heart; river, tributary to Peace river, below Smoky river, Alberta.

North Kootenay; pass, in the Rocky mountains, near the headwaters of Flathead river, Alta. and Kootenay district, B.C.

North Lincoln. See Ellesmere.

North Lizard. See Rowe.

North Mya. See Miscou.

North Nation. See Petite Nation.

North of Halfway. See Meule.

North Peak. See Garibaldi hill.

North Porpoise. See Ridley.

Northport; shoal and village, Sophiasburg township, Prince Edward county, Ont.

North Road. See North Head.

North Rustico; lightstation and post village, Queens Co., P.E.I. (Not Grand Rustico.)

Norths; post village, Kings county, N.S. (Not North Corner.)

North Skeena. See Inverness.

North Somerset. See Somerset.

North Star; hill, north of St. Mary river, Kootenay district, B.C.

Northumberland; channel, between Gabriola and Vancouver islands, B.C.

Northumberland. See Cumberland.

North Vermilion; settlement, on north side of Peace river, Alberta.

Northwest Angle; also Northwest Angle inlet, Lake of the Woods, international boundary, Man., Ont. and U.S.

North Wiltshire. See Wiltshire.

North Wind; lake, southeast of Humboldt bay, lake Nipigon, Thunder Bay district, Ont. (Not North Wing.)

Norway; island, northeast of Kuper island, southeast coast of Vancouver I., B.C.

Nose. See Ribstone.

Notre-Dame-des-Laurentides; parish, Quebec county, Que.

Notre-Dame-du-Portage; post village, Temiscouata county, Que.

Nottaway; river, flowing from Mattagami lake into James bay, Abitibi territory, Que. (Not Noddawai nor Nodway.)

Notukeu; creek, flowing easterly into Wood river, southern Saskatchewan.

Novelist. See Palmer.

Nowell; channel, in easterly portion of Queen Charlotte sound, B.C. (Not Noel.)

Noyes; mount, southeast of Waterfowl lakes, Rocky mountains, Alberta.

Nozheiatik; lake, east of Anzhekumming lake, Kenora district, Ont.

Nubble; mount, Goschen island, Hecate strait, Coast district, B.C.

Nulki; lake, on telegraph trail, south of Nechako R., Coast dist., B.C. (Not Noolki.)

Numnekaning. See Nunikani.

Nunikani; lake, Sherborne township, Haliburton county, Ont. (Not Numnekaning.)

Nuns; island, in the St. Lawrence, near Montreal, Hochelaga county, Que. (Not Nun nor St. Paul.)

Nurse. See Norse.

Nut; lake and mountain, also Nut Mountain, post office, eastern Saskatchewan.

Nutt; village, Missisquoi county, Que. (Not Nutt's Corners.)

Nutt's Corners. See Nutt.

Nyarling; river, tributary to Little Buffalo river, south of Great Slave lake, N.W.T.

O

Oak; lake, English river, above Maynard lake, Kenora district, Ont.

Oak; lake, Methuen township, Peterborough county, Ont.

Oak; point, also Oak Point village, west shore of lake Manitoba, Man.

Oakbank; post village, east of Winnipeg, Man. (Not Oak Bank.)

Oakland. See Slaughenwhite.

Oakville; creek, railway station, and town, Halton Co., Ont. (Not Sixteen Mile creek.)

Obadowagashing. See Dasserat.

Obalski; lake, Bearn, Castagnier, Dalquier and Duverny Tps., Timiskaming, Que.

Obashi; lake, northwest of Attawapiskat lake, Patricia district, Ont.

Obashing; lake, Timiskaming county, Que. (Not Big Obashing.)

Obashkong; lake, Cassels township, Nipissing district, Ont.

Obaska; lake, north of Grand L. Victoria, Timiskaming county, Que. (Not Obiska.)

Obatawagush; lake, west of Harricanaw river, Abitibi territory, Que.

Obatogamau; lake, at height of land south of Chibougamau L., Abitibi territory, Que.

Obiduan; lake, at headwaters of St. Maurice river, Champlain county, Que.

Obikoba; lake, northeast of lake Timiskaming, Timiskaming county, Que.

Obiska. See Obaska.

Obonga; lake, west of lake Nipigon, Thunder Bay district, Ont.

Oboshkegan; lake, S. of N. T. Ry. and N. of Onaman lake, Thunder Bay dist., Ont.

Obowanga; river, northwest of Obonga lake, Thunder Bay district, Ont.

O'Brien; creek, at international boundary, west of Cudahy, Yukon.

Observation; butte, near Gun lake, north of Nahlin river, Cassiar district, B.C.

Observation; peak, east of Peyto lake, Alberta. (Not Mount Observation.)

Observation. See Jupiter.

Ochig; lakes, north of L. St. Joseph, Patricia district, Ont.

O'Connor. See Kaskawulsh.

O'Conor; island, Navy group, St. Lawrence river, Leeds Co., Ont. (Not O'Connor.)

Octave; river, flowing northeasterly from Chikobi lake to Harricanaw river, Abitibi territory, Que. (Not Shi-shi-shi.)

Octopus; islands at the entrance to Waiatt bay, Okisollo channel, Coast district, B.C.

Odaray; mount, south of Cathedral mountain, Kootenay district, B.C.

Odaray; pass, between Mts. Duchesnay and Odaray, Yoho park, Rocky Mts., Kootenay district, B.C.

Odei; river, tributary to Burntwood river, Manitoba. (Not Sahpoochaway.)

Odellach; river, tributary to Tobique river, Victoria county, N.B. (Not Otelloch.)

Odin; mount, west of Upper Arrow lake, Kootenay district, B.C.

O'Donnel; river, emptying into E. side of Atlin L. Cassiar, B.C. (Not Dixie creek.)

Oesa; lake, southwest of mount Lefroy, Kootenay district, B.C.

Ogani; lake, on Wenasaga river, northwest of lac Seul, Patricia district, Ont. (Not Oganie nor Powingow.)

Ogden; mount, northwest of Hector station, Rocky mountains, Kootenay district, B.C.

Ogilvie; creek, emptying into the north end of lake Laberge, Yukon.

Ogilvie; post on Yukon river, near the mouth of Sixtymile river, Yukon.

Ogilvie; range of mountains, central Yukon.

Ogilvie; valley, north of lake Laberge, Yukon.

Ogoki; lake and river, tributary to Albany R., Thunder Bay dist., Ont. (Not Tiernan.)

Ogre; peak, near headwaters of Amiskwi river, Rocky Mts., Kootenay district, B.C.

O'Hara; lake, west of mount Lefroy, Rocky Mts., Kootenay dist., B.C. (Not Cascade.)

Oies (cap aux); cape, below Coudres island, St. Lawrence river, Charlevoix county, Que. English usage Goose cape, which see.

Oiseau; lake and river, southeast of lake Winnipeg, Man. (Not Bird.)

Oke; mount, south of Misko pass, Yoho park, Rocky Mts., Kootenay district, B.C.

O'Keefe; mount, between Sloko and Silver Salmon rivers, Cassiar district, B.C.

Okemasis; lake, east of Carlton, central Saskatchewan. (Not Stony.)

Okikodosik; river, flowing southwesterly into Abitibi lake, Timiskaming, Ont. and Que. (Not Okikodosee.)

Okisollo; channel, between Quadra and Sonora Is., Coast dist., B.C. (Not Okishollow.)

Okotoks; mountain, post office, and railway station, southern Alberta.

Old Bluff. See Yeo.

Old Factory; river, emptying into James bay, New Quebec. (Not North.)

Oldfield. See Hays.

Old Fort; bay and point, in southwestern portion of Athabaska lake, also river flowing into the bay, Alberta.

Oldman; river, tributary to Belly river, Alberta. (Not Old Man's.)

Oldman; rock, Yukon river, between Cudahy and international boundary, Yukon.

Old Wives. See Chaplin.

Oldwoman; rock, Yukon river, near Oldman rock, Yukon.

Olga; lake, southeast of Mattagami lake, Abitibi territory, Que.

Olga; river, north shore of Hudson strait, N.W.T.

Olive; mountain, northeast of mount Gordon, Rocky mountains, Alberta.

Oliver; mount, southwest of Mount Bonney, Selkirk mountains, Kootenay district, B.C.

Olivine; mountain, south of Tulameen river, Yale district, B.C.

Olomanoshibo; river, Saguenay Co., Que. (Not Olomanosheebo nor Olomonasheebou.)

Omanek; island, east shore Ungava bay, New Quebec.

Omatuwi; lake, north of Split lake, Nelson river, Manitoba. (Not O-Ma-Tou-Wi.)

Ombabika; bay, island, and river, N. shore of L. Nipigon, Thunder Bay district, Ont.

Omenica. See Omineca.

Omineca; mountains and river, Cassiar, B.C. (Not Omenica, Ominica, nor Omeneca.)

Onamakawash; lake, southwest of Smoothrock lake, Thunder Bay district, Ont.

Onaman; lake and river, emptying into Humboldt bay, Nipigon lake, Thunder Bay district, Ont. (Not Onamanisagi.)

Onamanisagi. See Onaman.

Onatamini; brook, flowing into Wekusko lake, Manitoba.

Onderdonk; point, Ameliasburg township, Prince Edward county, Ont.

O'Neil; island, west of Grenadier island, St. Lawrence river, Leeds county, Ont. (Not Bluff nor Hog.)

O'Neil; post office, Huntingdon Co., Que. (Not O'Neil's Corners nor O'Neil Corners.)

O'Neill's Corners. See O'Neil.

Oneman; lake, English R., Kenora district, Ont. (Not Lone Man's nor One Man's.)

Onkammis; lake, at headwaters of St. Maurice river, Champlain county, Que.

Ooskootim. See Wuskwatim.

Ootsa; lake, southwest from Francois lake, Coast district, B.C. (Not Ootsabunket.)

Opabin; creek, tributary to Brazeau river, central Alberta. (Not Boulder nor Rocky.)

Opachuanau; lake, on Churchill river, below Nemei river, Sask. (Not Pachewanow.)

Opal; mountains, east of Kananaskis river, Rocky Mountains park, Alta.

Opamiska. See Opemiska.

Opasatika; lake, south of Abitibi lake, Timiskaming county, Que.

Opatawaga; lake, northwest of Mattagami lake, Abitibi, Que. (Not Opiwatakan.)

Opawika; river, tributary to Waswanipi river, Abitibi territory, Que.

Opegano; lake, on Burntwood river, Manitoba.

Opemiska; lake, west of Chibougamau lake, Abitibi territory, Que. (Not Opamiska.)

Opeongo; railway station and river, in southeastern portion of Algonquin National park, Nipissing district, Ont. (Not Great Opeongo lake.)

Opequanne. See Opikwan.

Opequon. See Opikwan.

Ophir; creek, tributary to Indian river, Yukon.

Opichuan; river, flowing to Nameiben L., Thunder Bay dist., O. (Not Opichewan.)

Opikeigen; lake, northwest of Eabemet lake, Patricia district, Ont.

Opikwan; lake, upper waters of Ottawa river, Pontiac county, Que. (Not Opequanne nor Opequon.)

Opinaca. See Opinaka.

Opinaka; river, tributary to Eastman river, New Quebec. (Not Opinaca nor Straight.)

Opinnagau; river, north of Ekwan river, Patricia district, Ont. (Not Upinnakaw.)

Opitsat; Indian village, southwest end of Meares island, Clayoquot sound, Vancouver island, B.C. (Not Clayoquot.)

Opiwatakan. See Opatawaga.

Oponask; lake, northeast of Sachigo lake, Patricia, Ont. (Not Little Sachigo.)

Opuntia; lake, southeast of Tramping lake, Sask.

Orchard; point, opposite Atherley, at northern end of lake Simcoe, Simcoe county, Ont.

Orchay; river, tributary to Pelly river, west of Ross river, Yukon.

Ord; lake, southwest of McIntyre bay, L. Seul, Kenora dstrict, Ont. (Not Long.)

Orient. See Pijitawabik.

Orignal; bay and cape, Rimouski county, Que. (Not Arignole.)

Orignaux (pointe aux); point, St. Lawrence river, Kamouraska county, Que.

Orleans; post office, Gloucester Tp., Carleton Co., Ont. (Not St. Joseph d'Orleans.)

Orme (anse à l'); (cap à l'); (rivière à l'); bay, cape, and river, Jacques Cartier county, Que. (Not Tortue river.)

Oromocto; island, lake, river, village, Sunbury and York Cos., N.B. (Not Oronocto.)

Ormonde; creek, flowing into Fraser lake, Cariboo district, B.C. (Not Canyon.)

Oronocto. See Oromocto.

Ortell; mount, in Tasin mountains, Yukon.

Osborn; bay, west side of Stuart channel, Vancouver island, B.C.

Osborn; cove, in upper portion of Prince Rupert harbour, Coast district, B.C.

Osbourne; bay, Eagle lake, Kenora district, Ont. (Not Osbourne's)

Osgoode; mount, between forks of Macmillan river, Yukon.

Osier. See Hosier.

Osipasinni; lake, east of Kakagi lake, Kenora district, Ont. (Not Boulder.)

Osisko; lake, southeast of Abitibi lake, Timiskaming county, Que.

Oskelaneo; lake, at headwaters of St. Maurice river, Champlain county, Que.

Osnabruck; township, and Osnabruck Centre, post village, Stormont county, Ont. (Not Oznabruck.)

Osoyoos; lake, on international boundary, Similkameen district, B.C. (Not Osooyos.)

Ospwagan; lake, north of Paint lake, Manitoba. (Not Pipe nor Pipestone.)

Ostrander; point, Marysburg township, Prince Edward county, Ont. (Not Gravelly.)

O'Sullivan; lake, at headwaters of Ottawa river, Montcalm county, Ont.

O'Sullivan; settlement, York county, Ont. (Not O'Sullivan's Corners.)

O'Sullivan; river, flowing through Puskitamika lake into Waswanipi lake, Abitibi territory, Que.

Otakus; lake, north of Berry lake, Kenora district, Ont. (Not Otakoose.)

Otanabi; lake, northwest of Grand lake Victoria, Timiskaming, Que.

Otauwau; river, tributary to Lesser Slave river, Alberta. (Not O-Tow-Wow.)

Otchisk; river, tributary to Waswanipi river, Abitibi territory, Que.

Otelloch. See Odellach.

Otoskwin; lake and river, tributary to Badesdawa L., upper Winisk R., Patricia, Ont.

O-Tow-Wow. See Otauwau.

Ottawa; city, Carleton county, Ont.

Ottawa; creek, tributary to Dominion creek, Yukon.

Ottawa; lake, in Joliette county, Que.

Ottawa; river, which in lower portion forms the boundary between Ont. and Que.

Otter; point, west of Sooke bay, Vancouver island, B.C.

Otter. See Big Otter.

Otter. See Fantail.

Otterhead; river, tributary to Kicking Horse river, Kootenay district, B.C.

Ottertail; falls, in Ottertail river, above Goodsir creek, Yoho park. Rocky Mts., Kootenay district, B.C.

Ottertail; river, mountain range, and railway station, Kootenay district, B.C.

Otty; island, Navy group, St. Lawrence river, Leeds county, Ont.

Ouasiemska. See Washimeska.

Oulac. See Aulac.

Outer. See Henry.

Outer Bay of Long Pt. See Long Point bay.

Outer Duck; island, east of Great Duck island, the most southerly of the Duck islands, Manitoulin district, Ont.

Outer island of Port Hood. See Henry.

Outer Sturgeon. See McCreary.

Oval. See Kawawia.

Overflow; lake, on Olga river, north shore of Hudson strait, N.W.T.

Overflowing; river, emptying into the northwest end of lake Winnipegosis, Man.

Owen; bay, north shore of Okisollo channel, Coast district, B.C.

Owen; channel and island, between Manitoulin and Fitzwilliam islands, Manitoulin district, Ont.

Owen; island, Navy group, St. Lawrence river, Leeds county, Ont.

Owen; mount, south of Cathedral mountain, Kootenay district, B.C.

Owen; point, between Athol and Wellington bays, Pr. Edward Co., Ont. (Not West.)

Owl; river, flowing from Heart lake to L. LaBiche, central Alberta.

Ox; point, the western extremity of point Anne, Thurlow township, Hastings Co., Ont.

Oxdrift; railway station, Kenora district, Ont.

Oxstall. See Ecstall.

Oxtongue; lake and river, Haliburton county, Ont. (Not Ox Tongue.)

Oyster (harbour). See Ladysmith.

Oyster; peak, west of mount Douglas, Rocky mountains, Alberta.

Oznabruck. See Osnabruck.

Ozhiski; lake, southwest of Attawapiskat lake, Patricia district, Ont.

Ozhuskans; rapids, upper Winisk river, Patricia district, Ont.

P

Pachena; point, south of Pachena bay, west coast of Vancouver island, B.C. (Not Beegadoss nor Beeghadoss.)

Pachewanow. See Opachuanau.

Packhoon. See Pakhoan.

Paddle; river, tributary to Pembina river, Alberta.

Paddle. See Boyer.

Paddling; lake, north of Blaine lake, central Saskatchewan.

Pagaonga. See Papaonga.

Pagato; lake and river, tributary to Churchill R., east of Reindeer R. central Sask.

Page; lagoon, south of Hammond bay, southeast coast of Vancouver island, B.C.

Page; point, Ladysmith harbour, east coast of Vancouver island, B.C.

Paget; peak, northwest of Hector station, Rocky mountains, Kootenay district, B.C.

Pagwachuan; lake, and river tributary to Kenogami river, Algoma and Thunder Bay districts, Ont. (Not Bagutchuan river, Pawgutchewan river, Powgulchuan lake, nor Pawghtchewan lake.)

Paincourt; post village, Kent county, Ont. (Not Dover South nor Pain Cour.)

Painkiller. See Gamskagamik.

Painsec; post village and Ry. station, Westmorland Co., N.B. (Not Painsec Junction.)

Paint; lake and river, tributary to Grass river, Manitoba. (Not Manuminan.)

Paisley; point, Douglas channel, west of Maitland island, Coast district, B.C.

Pakhoan; lake, on Severn river, Patricia, Ont. (Not Little Cedar nor Packhoon.)

Pakitanika. See Blouin.

Pak-oghkee. See Pakowki.

Pakonsigane; river, upper waters of Manuan river, St. Maurice county, Que.

Pakowagaming. See Pakowkami.

Pakowcaming. See Pakowkami.

Pakowkami; lake, in Gladstone township, Algoma district, Ont. (Not Pakowagaming nor Pakowcaming.)

Pakowki; lake, southeastern Alberta. (Not Pakokee, Pak-oghkee, nor Peekopee.)

Pakwa; lake, on Grass river, Manitoba. (Not Pakwahigan, Paquehigan nor Sandy.)

Pakwahigan. See Pakwa.

Pakwash; lakes, northwest of lac Seul, Patricia district, Ont. (Not Little Shallow, Paquash nor Shallow.)

Palisade; mountain northwest of Sir Sandford range, Selkirk mountains, B.C.

Palliser; mountain range, pass and river, Rocky mountains, Kootenay, B.C.

Palmer; mount, easterly termination of Sir Sandford range, creek tributary to Gold river, also glaciers in the Selkirk mountains, Kootenay district, B.C. (Not Novelist creek and mountain, nor west branch of Gold river.)

Palmer Bar; creek, tributary to Moyie river, Kootenay district, B.C.

Pantage; lake, on telegraph trail, south of Blackwater river, Cariboo district, B.C. (Not Pelican.)

Panther; river, flowing northeasterly into Red Deer river, Rocky mountains, Alta.

Papaonga; river, tributary to Wenasaga river, above Slate lake, Patricia district, Ont. (Not Papagonga.)

Papineau; brook and lake, Wicklow township, Hastings county, Ont.

Papineau; lake, Ottawa county, Que. (Not Lac du Commandant.)

Papineau d'Abbotsford; post office and railway station, Rouville county, Que.

Paquash. See Pakwash.

Paquehigan. See Pakwa.

Paquin; lake, northwest of Crean lake, central Saskatchewan. (Not Cross.)

Paradise; mountain peak, south of Sloko river, Cassiar district, B.C.

Paradise; valley, north of mount Temple, Alberta.

Paradise. See Lodestone.

Parc-Laval; post office, Laval county, Que.

Parisian. See Parisienne.

Parisienne (île); island, Whitefish bay, L. Superior, Ont. (Not Parisian island.)

Parizeau; point, on east coast of Digby I., Prince Rupert harbour, Coast dist, B.C.

Park; mount, west of mount Biddle, Rocky mountains, Kootenay district, B.C.

Parker; creek, tributary to Klondike river, Yukon.

Parker; island and landing, south of Shute point, Bruce county, Ont.

Parkhill; village and railway station, Middlesex county, Ont. (Not Park Hill.)

Parkins; cape, at west entrance to Quatsino sound, Vancouver island, B.C.

Parks; lake, southeast of lake Nipigon, Thunder Bay district, Ont.

Parrsboro; parish, river, and town, Cumberland county, N.S. (Not Parrsborough.)

Parry; bay, southwest of Esquimalt, Vancouver island, B.C.

Parrywood; railway station, Kenora district, Ont.

Parson; rock, Active pass, strait of Georgia, New Westminister district, B.C.

Partipique. See Portapique.

Parton; river, tributary to Tatshenshini river, Cassiar district, B.C.

Partridge; creek, flowing into Wheaton river, also pass, southern Yukon.

Partridge; falls, Pigeon R., near Grand portage, Int. boundary, Thunder Bay dist., O.

Partridge Crop. See Pineimuta.

Pas; post office and railway station, at the mouth of Pasquia river, Sask. (Not Le Pas nor The Pas.) Previous decision revised.

Pasayten; river, tributary to Similkameen river, Similkameen and Yale districts, B.C. (Not Pasayton.)

Pashashibu; bay, Saguenay county, Que. (Not Pashasheeboo.)

Pashkokogan; lake and river, southeast of L. St. Joseph, Thunder Bay district, Ont

Pasiminikana; lake, at headwaters of St. Maurice river, Champlain county, Que.

Paskagama; lake, upper waters of Migiskan river, Pontiac county, Que.

Paskekegan. See Piskahegan.

Pasquia; range of hills, also river tributary to the Saskatchewan, Manitoba and Sask. (Not Basquia nor Basquian.)

Pass. See Blakiston.

Patauquin. See Petauguin.

Patience; lake, Tp. 36, R. 3, W. of 3 M., southern Saskatchewan.

Patterson; bay and point, St. Lawrence river, Yonge township, Leeds county, Ont. (Not Chimney Island point.)

Paudash; brook, lake, and post office, Cardiff township, Haliburton county, Ont.

Paugh; lake, Sherwood towship, Renfrew county, Ont.

Pauktorvik; island, southwest shore Ungava bay, New Quebec.

Paul; creek and lake, tributary to N. Thompson river, north of Kamloops, Kamloops district, B.C. (Not Reservation.)

Paul; mount, near southeast end of Maligne lake, Rocky Mts., western Alberta.

Pawghtchewan. See Pagwachuan.

Pawgutchewan. See Pagwachuan.

Payne; lake, and river emptying into Ungava bay, New Quebec. (Not Tasurak.)

Payoonan. See Peonan.

Peace; hills, west of Wetaskiwin, central Alberta.

Peace; large river, Cariboo district, B.C., and northern Alberta.

Peach; island, at outlet of lake St. Clair, Essex county, Ont. (Not Isle au x Pêches.)

Peak; lake, southwest of Dinorwic lake, Kenora district, Ont.

Pear. See Dromedary.

Pearce; mount, northwest of Mt. McNicoll, Selkirk Mts., Kootenay district, B.C.

Pearl; island, with lightstation thereon, outside of the entrance to Mahone bay, Lunenburg county, N.S. To avoid duplication of "Green island lightstation," Richmond county. Pearl—name of lightkeepers since 1873.

Pearson; island, west of Belanger point and east of Greene island, Manitoulin district, Ont. (Not Little Grant.)

Pearson's. See Ferguson.

Peashteebee. See Piashti.

Peavine; creek, tributary to Moyie river, Kootenay district, B.C.

Pebble. See Lowes.

Peck: lake, south of Ministikwan lake, central Saskatchewan. (Not Little Fishing.)

Peckagomique. See Becaguimec.

Pedder; bay and inlet, south of Parry bay, Vancouver island, B.C.

Peechee; mount, south of Mt. Girouard, Rocky mountains, Alberta.

Peekopee. See Pakowki.

Peel; island, northeast of Grenadier island, St. Lawrence river, Leeds county, Ont. (Not Prince Edward nor Tent.)

Peel; shoal, off Peel island, northeast of Grenadier island, St. Lawrence river, Leeds county, Ont. (Not Tent Island shoal.)

Pee-pee-ke-wah-be-kung. See Pipikwabi.

Peerless; lake, Tps. 87 and 88, Rges. 4 and 5, W. 5th M., Alberta. (Not Trout.)

Peeshabo. See Pishabo.

Pegamasai; lake, in Montgomery township, Algoma district, Ont. (Not Pegamasay.)

Peggy Cove; village, Halifax county, N.S. (Not Peggy's Cove.)

Pe-kange-kum. See Pikangikum.

Pekangikum. See Pikangikum.

Pekisko; creek, tributary to Highwood R., Alta. (Not Middle Branch of Highwood R.

Pelee; island and point, and Pelee Island post office, Essex county, Ont. (Not Pele nor Pointe Pelee.)

Pelerin; settlement, Kent county, N.B. (Not Pelering nor Puellering.)

Pelerins (Les); islands, St. Lawrence river, Kamouraska county, Que. English usage: Pilgrim islands, which see.

Pelican; lake, north of Minnitaki lake, Kenora district, Ont.

Pelican. See Chitek.

Pelican. See Lavallée.

Pelican. See Pantage.

Pelican. See Primeau.

Pelletier; lake, Rouyn township, also creek flowing from the lake to Kekeko lake, Timiskaming county, Que. (Not Lorenzo.)

Pelly; mountains, lakes, and river, Yukon.

Pemberton; meadows, on Lillooet river, above Lillooet lake, also pass, portage, and post office, between Anderson and Lillooet lakes, B.C.

Pembina; mountain and river, southern Manitoba.

Pembina; river, tributary to Athabaska river, central Alberta.

Pembina. See Christina.

Pembroke. See Allumette.

Pemichangan; lake, Ottawa county, Que. (Not Mushonga, Pemichangau, Pemichangaw, nor Penichangan.)

Pen; lake, Nightingale township, Haliburton county, Ont.

Penassi; lake and river, west of Manitou lake, Kenora district, Ont.

Pencil; lake, Cavendish township, Peterborough county, Ont.

Pender; island, in southern portion of the strait of Georgia, B.C.

Pender. See Brabant.

Pender. See Walkem.

Pend d'Oreille; river, flowing into Columbia river, near the international boundary, Kootenay district, B.C.

Penetangore; river, emptying into lake Huron at Kincardine, Bruce county, Ont.

Penetanguishene; town, Simcoe county, Ont. (Not Penetang.)

Penichangan. See Pemichangan.

Penitentiary; shoal, southwest of Kingston, Frontenac Co., Ont. (Not Prince Regent.)

Penny. See Cumberland.

Penrose; mount, in forks of Bridge river, Lillooet district, B.C.

Pentamerus; point, Crane bay, lake Manitoba, Man.

Pentecôte; river, Saguenay county, Que. (Not Pentecost.)

Peonan; creek, tributary to Saskatchewan river, near Ft.-à-la-Corne, Sask.

Peonan; point, in northerly part of lake Manitoba, Man. (Not Payoonan.)

Pepechekau. See Pipishikau.

Pepin; point, east entrance Tuck narrows, Prince Rupert harbour, Coast dist., B.C.

Pepisquew. See Weibikwei.

Pequaket. See Pikwaket.

Perault. See Perrault.

Perch; island, northeast of Gordon I., St. Lawrence R., Leeds Co., Ont. (Not Reed.)

Percy; lake, Harburn township, Haliburton county, Ont.

Pereault. See Perrault.

Pereleshin; mountain, near Stikine R., between Anuk and Scud Rs., Cassiar dist., B.C.

Peribonka; river, emptying into lake St. John, Que. (Not Peribonca.)

Perkins; creek and peak, north of Pugh peak, southern Yukon.

Perkins; rock, S.W. of Ruel shoal, entrance to Key harbour, Parry Sound dist., O.

Perley rock; mountain spur, near Terminal peak, Selkirk Mts., Kootenay district, B.C.

Perpisawick. See Petpeswick.

Perrang; cove, east shore of St. Margaret bay, Halifax county, N.S. (Not Perrin.)

Perrault; lake, west of McIntyre bay, L. Seul, Kenora district, Ont. (Not Perault nor Pereault.)

Perrin. See Perrang.

Perry; creek, tributary to St. Mary river, Kootenay district, B.C.

Perry; ridge, west of Slocan river, Kootenay district, B.C. (Not Perry's.)

Perseverance; island, west of Fitzwilliam island, Manitoulin district, Ont.

Persil (port au); bay, Charlevoix county, Que.

Perther's. See Perthes.

Perthes; point, in northerly portion of Tagish lake, Yukon. (Not Perther's.)

Petatstekupau. See Petitsikapau.

Petauguin; lake, in Galbraith township, Algoma district, Ont. (Not Pataguin.)

Petawawa; military reserve, railway station, river, township, and village, Renfrew county, Ont. (Not Petewawa.)

Petcoudiac. See Petitcodiac.

Peter; rock, off the north shore of lake Ontario, between Cobourg and Port Hope, Northumberland county, Ont. (Not Gale island nor Gull rock.)

Peter's. See Petrie.

Peterson; lake, southeast of Cobalt, Timiskaming district, Ont.

Peterson; range of mountains, northwest of lake Laberge, Yukon.

Peters Road; village, Kings county, P.E.I. (Not Peter's Road.)

Petewawa. See Petawawa.

Pethick; point, on east side of Prince Rupert harbour, Coast district, B.C.

Pethinue; peninsula, Great Slave lake, N.W.T. (Not Peth-the-nu-eh.)

Petishikupau. See Petitsikapau.

Petit Chicot. See Chicot.

Petitcodiac; river, Albert and Westmorland counties, N.B. (Not Petcoudiac nor Petit Coudiac.)

Petitdegrat; inlet, island, and post office, Richmond county, N.S. (Not Petit Degrat nor Petit de Grat.)

Petite. See Walton.

Petite Ile aux Cygnes. See Sévigny.

Petite-Nation; river, tributary to the Ottawa, from the north. (Not Nation nor North Nation.)

Petite Nation. See South Nation.

Petit-Rocher; post village and railway station, Gloucester county, N.B. (Not Petite Roche nor Petite Rocher.)

Petitsikapau; lake, north of Ashuanipi river, New Quebec. (Not Petatstekupau, Petishikupan, nor Petshikupau.)

Petpeswick; harbour, inlet, lake, and post office, Halifax county, N.S. (Not Perpisawick nor Petpiswick.)

Petrie; reef, at east entrance to Sydney harbour, Cape Breton county, N.S. (Not Peter's, Petre, nor Petrie's.)

Petrolia; town, Lambton county, Ont. (Not Petrolea.)

Petshikupau. See Petitsikapau.

Peveril; mountain peaks, southwest of Goodwin creek, Cassiar district, B.C.

Peyto; glacier and lake, northwest of Bow lake, Alta. (Not Peyto's nor Glacier lake.)

Pheasant; creek and hill, north of Qu'Appelle river, southeastern Saskatchewan.

Phelan; railway station, north shore of Skeena river, Coast district, B.C.

Philip; river, emptying into Northumberland strait, N.S. (Not Phillip.)

Philips; cove, east of Pillsbury cove, Prince Rupert harbour, Coast district, B.C.

Philips; point, east coast of Digby I., Prince Rupert harbour, Coast district, B.C.

Phillip. See Philip.

Phillipps; creek, flowing southwesterly across the international boundary, east of Gateway, Kootenay district, B.C. (Not Phillips.)

Phillips; shoal, northeast of Main island, entrance to Key harbour, Georgian bay, Parry Sound district, Ont.

Philmonro; settlement, Kings county, N.B. (Not Philmaro nor Philomaro.)

Phœbe; point, northwesterly point of Fitzwilliam island, Manitoulin district, Ont.

Photograph; mountain, Kitimat arm, Coast district, B.C.

Piapot; creek, flowing into Crane lake, southwestern Saskatchewan.

Piashti; bay and river, Saguenay county, Que. (Not Peashte-bai, Piastre bay, nor Peashteebee river.)

Piastre. See Piashti.

Piché; lake, Dubuisson and Fournière townships, Timiskaming county, Que. (Not High Water nor Kamoukakwiti.)

Pichenninnis; brook, flowing into Butler lake, Kenora district, Ont.

Pichinamei; lake, south of Attawapiskat lake, Patricia district, Ont.

Pickering. See Frenchman.

Pickitigouching. See Pikitigushi.

Pickle; lake, east of Kapkichi lake, upper Winisk river, Patricia district, Ont.

Pickwaket. See Pikwaket.

Picnic. See Cockburn.

Picnic. See Stovin.

Picture Narrows; lake, west of Manitou lake, Kenora district, Ont.

Piegan; creek, flowing into Sevenpersons coulée, southeastern Alberta.

Pieromonta; river, emptying into Kempt lake, St. Maurice county, Que.

Pierre; (rivière à) river, tributary to Batiscan river, Portneuf county, Que. See also Rivière-à-Pierre.

Piers; island, Satellite channel, southeast coast of Vancouver I., B.C. (Not Pier.)

Pigeon; bay, falls and point, also river flowing into the bay and forming part of the international boundary, Thunder Bay district, Ont.

Pigeon; mountain, south of Bow river, Rocky Mountains park, Alberta.

Pijitawabekong. See Pijitawabik.

Pijitawabik; bay, east of mouth of Nipigon river, L. Nipigon, Thunder Bay district Ont. (Not Orient, Pijitawabekong, Pijitawbikong, nor Pittiwabikong.)

Pijitawabikong. See Pijitawabik.

Pijuwyan; lake, and river tributary to Waswanipi river, Abitibi territory, Que.

Pika; peak, northeast of Laggan, Rocky mountains, Alberta.

Pikangikum; Indian reserve and lake, on Berens river, Patricia district, Ont. (Not Pe-kange-kum nor Pekangikum.)

Pikapao; river, tributary to Moisie river, Saguenay county, Que. (Not Pikopao.)

Pike; lake, mountain, and river, south of Atlin lake, Cassiar district, B.C.

Pikitigushi; river, emptying into the northern end of Nipigon lake, Thunder Bay district, Ont. (Not Pickitigouching nor Muddy.)

Pikopao. See Pikapao.

Pikwaket; brook and mountain, Kings county, N.B. (Not Pequaket nor Pickwaket.)

Pilgrim; islands ('The Pilgrims'), also shoal, St. Lawrence river, Kamouraska county, Que. French usage: Les Pélerins, which see.

Pilkington; mount, north of Blaeberry river, Rocky Mts., Kootenay district, B.C.

Pillsbury; cove, east of Venn passage, Prince Rupert harbour, Coast district, B.C.

Pilot; bay, Gabriola island, southeast coast of Vancouver island, B.C.

Pilot; bay and point, and Pilot Bay settlement, Kootenay lake, Kootenay district, B.C. (Not Cape Horn nor Pirate bay.)

Pilot; island, northeast of Grenadier island, St. Lawrence river, Leeds county, Ont.

Pilot; lake, Burleigh township, Peterborough county, Ont.

Pilot; point, southeast corner of Gribbell island, Coast district, B.C.

Pimbury; point, Departure bay, Vancouver island, B.C. (Not Pinbury.) Previous decision revised.

Pinbury. See Pimbury.

Pinched-neck; lake, at headwaters of Rupert river, north of Mistassini lake, Mistassini territory, Que.

Pine; island, near Key harbour, Georgian bay, Parry Sound district, Ont.

Pine; lake, northwest of Gunflint lake, international boundary, Thunder Bay district, Ont. (Not Island Portage lake.)

Pine; point, Weller bay, Ameliasburg township, Prince Edward county, Ont.

Pine. See Clark.

Pine. See Mermaid.

Pine. See Minago.

Pine. See Shingwak.

Pine channel. See Kapikik lake.

Pine Island lake. See Cumberland lake.

Pineimuta; lake, west of L. St. Martin, Manitoba. (Not Partridge Crop.)

Pineroot; river, emptying into Athapapuskow lake, Manitoba.

Pine Tree; harbour and point, southeast of Johnston harbour, Bruce county, Ont.

Pine Wood. See Frederick.

Pingston; creek, west of Upper Arrow lake, Kootenay district, B.C.

Pink; river, flowing northeasterly into Reindeer lake, Sask. (Not Vermilion.)

Pinnacle; mountain, southwest of mount Temple, Alberta.

Pinnacle. See Cathedral.

Pinto; butte, also creek tributary to Wood river, Sask. (Not Pinto Horse.)

Pipe; (rivière à la) river, flowing into L. St. John, Taillon township, Lake St. John county, Que.

Pipe. See Ospwagan.

Pipestone; lake, south of Cross lake, Nelson river, Manitoba.

Pipestone; pass and river, Rocky mountains, Alberta. (Not Pipe creek.)

Pipestone. See Ospwagan.

Pipikwabi; lake, Stanhope Tp., Haliburton Co., Ont. (Not Pee-pee-ke-wah-be-kung.)

Pipishikau; river, Saguenay county, Que. (Not Pepechekau.)

Pipmakan; lake, Chicoutimi county, Que. (Not Pipmaukin nor Pitmuakan.)

Pirate. See Pilot.

Pisarinco. See Lorneville.

Pishabo; lake, Cassels township, Nipissing district, Ont. (Not Peeshabo.)

Pishidgi; lake, west of lake Nipigon, Thunder Bay district, Ont.

Piskahegan; river, tributary to Magaguadavic river, Charlotte county, N.B. (Not Paskekegan nor Piskehagan.)

Pita; lake, on Churchill river, below Reindeer river, Saskatchewan.

Pitchpine; island, Admiralty group, St. Lawrence river, Leeds county, Ont.

Pitmuakan. See Pipmakan.

Pitopiko; lake, an expansion of Manuan river, upper St. Maurice river, Champlain county, Que. (Not Pitopieco.)

Pitt; creek, tributary to St. Mary river, Kootenay district, B.C.

Pittiwabikong. See Pijitawabik.

Pitts; mount, southwest of the junction of Yukon, Lewes and Pelly rivers, Yukon.

Pizustigwan; river, northwest of Attawapiskat lake, Patricia district, Ont.

Plaster Cove (point). See Balache.

Plateau; creek, flowing into Torres channel, Atlin lake, Cassiar district, B.C.

Pleasant; point, the eastern extreme of Prince Edward county, Ont. (Not Indian.)

Plover; island, west coast Ungava bay, New Quebec.

Plum; creek and lake, tributary to Souris river, southwestern Manitoba.

Plumbob; creek, tributary to Kootenay river, Kootenay district, B.C.

Plumper; passage, channel between Discovery and Chain islands, Haro strait, New Westminster district, B.C. (Not Discovery.)

Plumper's. See Active.

Poboktan; creek, flowing northwesterly into Sunwapta river, also pass at head of the creek, Alberta.

Pockmouche. See Pokemouche.

Pocmouche. See Pokemouche.

Pocowagamis. See Pokowagamis.

Pohenagamuk; lake and post office, Pohenegamook township, Kamouraska county, Que. (Not Pohenagamooke nor Pohenegamook.)

Point; river, flowing into Sagemace bay, lake Winnipegosis, Manitoba.

Point Brulé. See Brulé.

Point de Bute. See Pont-à-Buot.

Pointe-à-la-Garde; village, Bonaventure county, Que. (Not Pointe la Garde.) Reversal of previous decision.

Pointe-au-Pic; village, Charlevoix county, Que.

Pointe-des-Monts; post office, Saguenay county, Que. (Not Pointe de Monts.) See also Monts.

Point Edward; town, Lambton county, Ont.

Point Fortune; post village, Vaudreuil county, Que.

Pointe Pelee. See Pelee.

Pointe-Platon; post settlement, Lotbinière county, Que. (Not Point Platon.)

Point-no-point. See Glacier.

Point Sapin; post village, Kent county, N.B.

Point Wolf; town, Albert county, N.B. (Not Point Wolfe.)

Pokemouche; river, Gloucester county, N.B. (Not Pockmouche nor Pocmouche.)

Poker; creek, branch of Walker creek, near international boundary, Yukon.

Pokesudi; island, at west entrance to Shippigan harbour, Gloucester county, N.B. (Not Poc Sudie, Poksudi, Pokesudie, Pokesuedie, nor Pokesoudie.)

Pokiok; river and village, York county, N.B. (Not Pokiock nor Poquiock.)

Pokkattawagan. See Pukkatawagan.

Pokowagamis; lake, and river tributary to Eel river, York county, N.B. (Not Pocowagamis nor Pocowogamis.)

Pollinger; mount, northeast of Kiwetinok peak, Rocky Mts., Kootenay district, B.C.

Ponass; lake, Tp. 38, R. 14, W. 2 M., Saskatchewan.

Ponhook; lake, in western portions of Halifax and Hants Cos., N.S. (Not St. Croix.)

Pont-à-Buot; village, Westmorland Co., N.B. (Not Point de Bute nor Pointe de Bute.)

Pontax; river, emptying into James bay, north of Rupert river, Mistassini territory, Que. (Not Pontiac.)

Pontiac. See Pontax..

Pontleroy; lake, Pontleroy township, Timiskaming county, Que. (Not Eel.)

Pooh-bah; lake, Hunter island, Rainy River district, Ont. (Not Pooh-Bah.)

Pool. See Poole.

Poole; creek, tributary to Birkenhead river, Lillooet district, B.C. (Not Pool.)

Poole; island, N. of Grenadier I. St. Lawrence R., Leeds Co., Ont. (Not Pool.)

Pooles Resort; village and summer resort, Leeds county, Ont. (Not Poole's Resort.)

Popes; peak, Bow range, Rocky Mts., Alta. and Kootenay dist., B.C. (Not Pope's.)

Popham; island, Navy group, St. Lawrence river, Leeds county, Ont.

Poplar; point, near the mouth of Rupert river, Mistassini territory, Que.

Poplar Point; parish and post settlement, on Assiniboine river, Man.

Poquiock. See Pokiok.

Porcupine; creek, tributary to Stikine R., south of Anuk R., Cassiar dist., B.C.

Porcupine; hills, southern Alberta.

Porcupine; mountain, northwestern Manitoba and Saskatchewan.

Porcupine; point and reef, southeast of cape Hurd, Bruce county, Ont.

Porcupine; river, tributary to Yukon river, northwestern Yukon.

Porlier; pass, between Galiano and Valdes islands, strait of Georgia, New Westminster district, B.C. (Not Portier.)

Porphyry; creek, flowing to Bulkley R., opp. Sharpe creek, Cassiar district, B.C.

Porphyry; island, point, and reef, south of Edward island, Manitoulin district, Ont.

Porpoise; channel, between Lelu and Ridley islands, also harbour in south side of Kaien island, Coast district, B.C.

Portage; bay, east of Peonan point, in northern portion of L. Manitoba, Man.

Portage; bay and point, east of Gatacre point, Manitoulin I., Manitoulin dist., Ont.

Portage; lake, west of Knife lake, international boundary, Rainy River district, Ont.

Portage-la-Prairie; parish and city, on Assiniboine river, Man.

Portal; peak, east of mount Baker, Alberta. (Not Mount Portal.)

Portapique; river and village, Colchester county, N.S. (Not Partipique nor Port au Pique.)

Port Arthur; lakeport city, Thunder Bay district, Ont.

Named Prince Arthur's Landing, in honour of H. R. H. Prince Arthur (Duke of Connaught), by Col. Wolseley, on the occasion of the landing of the troops of the Red River Expedition there, May 25th 1870. Incorporated as the town of Port Arthur, by statute of Ontario, March 25th, 1884.

Port-au-Persil; post village, Charlevoix county, Que. (Not Port Au Persil.)

Port-au-Saumon; post village, Charlevoix county, Que. (Not Port Salmon.)

Port Bickerton; village, Guysborough county, N.S. (Not Port Beckerton.)

Port Burwell; lightstation and village, Elgin county, Ont. (Not Big Otter Creek lightstation.)

Port Daniel; harbour and village, Bonaventure county, Que. (Not Port Daniel East nor St. George Port Daniel.)

Port Daniel East. See Port Daniel.

Port Darlington; harbour, at Bowmanville, Durham county, Ont.

Port Ebert. See Port Hebert.

Port Elgin; town, Bruce county, Ont.

Port Essington. See Essington.

Porter; creek, tributary to Indian river, Yukon.

Porter; lake, between Atlin and Gladys lakes, Cassiar district, B.C.

Porter; landing, at N. end of Dease L., Cassiar district, B.C. (Not Porter's landing.)

Porter's Landing. See Porter.

Port Hebert; village, Shelburne county, N.S. (Not Port Ebert, Big Port le Bear, Big Port l'Hebert nor Port L'Hebert.)

Port Hood; harbour and seaport town, Inverness county, N.S.

Port Hood; island, opposite Port Hood, Inverness county, N.S. (Not Smith's.)

Port Hood Island; post settlement, on Port Hood island, Inverness county, N.S.

Portier. See Porlier.

Port Joli; village, Queens county, N.S. (Not Port Jolie.)

Port L'Hebert. See Port Hebert.

Portland; island, west of Moresby island, southeast coast of Vancouver island, B.C.

Port Latour; village, Shelburne county, N.S. (Not Port la Tour nor Port Letour.)

Port Lewis; post office, Huntingdon county, Que. (Not Port Louis.)

Port Lorne; post office and lighthouse station, Annapolis county, N.S. (Not Marshall Cove nor Port Williams.)

Port Louis. See Port Lewis.

Port Maitland; lightstation and village, bay of Fundy, Yarmouth county, N.S. (Not Green Cove nor Maitland.)

Port Matoon. See Port Mouton.

Port Medway. See Medway.

Port Metway. See Medway.

Port Morien; village, on west side of Morien bay, Cape Breton county, N.S. (Not Cow Bay village nor Morien Bay village.

Port Mouton; village, Queens county, N.S. (Not Port Matoon.)

Portobello; stream, emptying into French lake, Sunbury county, N.B. (Not Porto Bello nor Portobella.)

Port Williams. See Port Lorne.

Possession; point, east of Sooke inlet, Vancouver island, B.C.

Pot-à-l'eau-de-vie. See Brandypot.

Potato; lake and river, emptying into south side of L. LaRonge, Sask.

Pothole; creek, tributary to St. Mary river, southern Alberta. (Not Pot Hole.)

Potter; point, Ameliasburg township, Prince Edward county, Ont.

Pottersburg; railway station and village, Middlesex Co., Ont. (Not London Junction.)

Pouce-Coupé; river, tributary to Peace river, Alberta. (Not Echafaud.)

Poulamon; bay, Richmond county, N.S. (Not Poulament nor Poulamond.)

Poverty; lake, Monmouth township, Haliburton county, Ont.

Povoas; mountain, east of the north end of lake Laberge, Yukon.

Power; lake, east of Anzhekumming lake, Kenora district, Ont.

Powgulchuan. See Pagwachuan.

Powingow. See Ogani.

Prairies (rivière des); river, separating, Laval county from Hochelaga and Jacques Cartier counties, Que. (Not Back river.) See also Rivière-des-Prairies.

Pratt; island and reef, southeast of Dead island, at entrance to Key harbour, Georgian bay, Parry Sound district, Ont.

Prejevalsky; point, Bennett lake, Yukon. (Not Prejevalski.)

Presbyterian; river, tributary to Leather river, eastern Saskatchewan.

Present. See Larder.

President; range of mountains and pass, west of Yoho valley, Rocky mountains, Kootenay district, B.C. (Not Emerald.) So named for the president of the Canadian Pacific Railway Company. *See also* 'The President.'

President. See Larder.

Presqu'île; bay, peninsula and point, near S.E. corner of Northumberland Co., Ont.

Presquile; river, tributary to St. John river, Carleton county, N.B. (Not Presqu'ile.)

Prevost; canyon, also river tributary to Ross river, Yukon.

Prevost; island, off the west end of Active pass, strait of Georgia, B.C.

Prevost; mount, east of Carboro bay, southeast coast of Vancouver island, B.C.

Prevost. See Kunghit.

Priam; lake, west of Manitou lake, Kenora district, Ont.

Price; township, Frontenac county, Que.

Prim; point, at entrance to Annapolis basin, Digby county, N.S. (Not Rogers.)

Primeau; lake, an expansion of Churchill river, Sask. (Not Pelican.)

Primrose; lake, north of Cold lake, central Alberta and Saskatchewan. (Not Goose.)

Prince Albert; peninsula, northwesterly portion of Victoria island, N.W.T. (Not Prince Arthur Land.)

Prince Albert Land. See Victoria island.

Prince Alfred; island, Brock group, St. Lawrence river, Leeds county, Ont.

Prince Arthur Land. See Prince Albert peninsula.

Prince Edward; bay and point, Prince Edward county, Ont. (Not South bay nor South Bay point.)

Prince Edward. See Peel.

Prince Henry Foreland. See Hopes Advance.

Prince of Wales. See Wales.

Prince of Wales; island, northwest of Boothia peninsula, Franklin.

Prince Patrick; island, north of Banks island, N.W.T.

Prince Regent; island, Lake Fleet group, St. Lawrence river, Leeds county, Ont. (Not Little Stave nor McDonald's.)

Prince Regent. See Penitentiary.

Prince Rupert; harbour, and Trans. Ry. terminus, Kaien island, Coast district, B.C.

Princess Charlotte; island, Lake Fleet group, St. Lawrence river, Leeds county, Ont.

Princetown; village, Prince county, P.E.I. (Not Prince Town.)

Pritzler; harbour, N. shore Hudson strait, N.W.T. (Not Pritzler's nor Jackman sound.)

Privateer; mountain, N.E. of Blackwater range of the Rockies, Kootenay dist., B.C.

Procter; creek and settlement, south of Balfour, Kootenay dist., B.C. (Not Proctor.)

Promise; island, at the entrance to Douglas channel, Coast district, B.C.

Protection; island, east of Nanaimo harbour, Vancouver island, B.C. (Not Douglas.)

Protection; mountain, east of Baker creek, Rocky mountains, Alberta.

Proud-sitting; lake, at headwaters of St. Maurice river, Champlain county, Que.

Providence; bay and point, south shore Manitoulin island, Manitoulin district, Ont.

Provoking; lake, in Algonquin National park, Nipissing district, Ont.

Pruden; bay, in south end of lake Winnipeg, Manitoba. (Not Pruden's.)

Prud'homme; lake, northeast of Rib lake, Timiskaming district, Ont.

Psyche; island, Lake Fleet group, St. Lawrence river, Leeds county, Ont.

Ptarmigan; creek, flowing into a large lake of the Pelly group, Yukon.

Ptarmigan; lake and peak, northeast of Laggan, Rocky mountains, Alberta.

Ptarmigan. See Titkana.

Puce; post village, also rivière aux Puces, Essex county, Ont.

Pudding; burn, tributary to St. Mary river, Kootenay district, B.C.

Puellering. See Pelerin.

Pugh; peak, northwest of the "big bend" of Wheaton river, southern Yukon.

Puke-lowogein. See Setting.

Pukkatawagan; lake and river, Churchill river, Manitoba. (Not Pokkattawagan. nor Puk-a-ta-wa-gan.)

Pulpit; peak, south of Turquoise lake, Rocky mountains, Alberta.

Pulpwood; point, southwestern side of Cockburn island, Manitoulin district, Ont.

Pulsatilla; mountain, southeast of mount Avens, Rocky mountains, Alberta.

Pulteney; point, southwestern extreme of Malcolm island, at entrance to Broughton strait, Coast district, B.C. (Not Graeme.) This is the point on which stands the lighthouse established in 1905.

Pulton; bay and point, south shore of Okisollo channel, Coast district, B.C.

Punichuan; bay, in the southern end of Mistassini lake, Mistassini territory, Que.

Punk; island, 3 m. S.E. Grindstone Pt., L. Winnipeg, Man. (Not Deer nor Reindeer.)

Punk. See Deer.

Purity; glacier and mountain, Selkirk mountains, B.C. (Not Lardo glacier.)

Purvis; bank, northwest of Greene island, Manitoulin district, Ont.

Puskitamika; lake, south of Waswanipi lake, Abitibi territory, Que.

Puslinch; lake, post village, Ry. sta., and Tp. Wellington Co., Ont. (Not Schaw sta.)

Pyramid; creek, tributary to St. Mary river, Kootenay district, B.C.

Pyramid; mountain, north of mount Grey, southern Yukon.

Q

Quaco; bay, head, ledge, and shoal, St. John county, N.B.

Quaco. See St. Martins.

Quadacha. See Kwadacha.

Quadra; hill, Galiano island, strait of Georgia, B.C.

Quadra; island, between Discovery passage and Okisollo channel, Coast district, B.C. The southern portion of what was formerly Valdes island.

Quamichan; lake and river, tributary to Cowichan river, Vancouver island, B.C.

Quaneca. See Kwadacha.

Qu'Appelle; lake, an expansion of Qu'Appelle river, Sask., the western in the chain of the "Fishing lakes"—which see. (Not Upper Fishing.)

Qu'Appelle; river, flowing easterly into the Assiniboine, southern Manitoba and Saskatchewan, also town in southern Saskatchewan.

Quarry; point, Manitoulin island, Manitoulin district, Ont.

Quarry. See Forsyth.

Quartet; lakes, near international boundary, Yale district, B.C.

Quartz; creek, branch of McDame creek, Dease river, Cassiar district, B.C.

Quartz; creek, tributary to Indian river, Yukon.

Quatawamkedgewick. See Kedgwick.

Quebec; creek, tributary to Yukon river, below Dawson, Yukon.

Quebec; head, eastern end of Wolfe island, Frontenac county, Ont. (Not East point.)

Queen; point, forms the western boundary of Walkhouse bay, Manitoulin island, Ont.

Queen Elizabeth; foreland, S.E. point of Loks Land, N.W.T. (Not North Foreland.)

Queensport; harbour, Guysborough Co., N.S. (Not Queen's Port nor Crow harbour.)

Queenston; village, and Queenston heights, Lincoln county, Ont. (Not Queenstown.)

Quesnel; lake, mining division, river, and village, Cariboo, B.C. (Not Quesnelle.)

Quetachu; bay, Saguenay county, Que. (Not Quetachoo.)

Quiet; lake, northeast of Teslin lake, Yukon.

Quill; lakes, southern Saskatchewan. (Not Big Quill and Little Quill.)

Quinitsa. See Kwinitsa.

Quinn; creek, branch of Sulphur creek, Indian river, Yukon. (Not Quin.)

Quinte; bay of, in L. Ontario, almost separating Prince Edward county from the mainland of Ontario. (Not Quinté.)

Quinze (lac des); lake, an expansion of the upper Ottawa river, Timiskaming, Que.

Quio; river, tributary to the Ottawa, Pontiac county, Que.

Quispamsis; post village, Kings county, N.B. (Not Quispansis.)

Quoieek. See Kwoiek.

Quyon; railway station and village, Pontiac county, Que. (Not Quio.) Reversal of previous decision.

R

Rabbit; mountain, Paipoonge township, Thunder Bay district, Ont.

Rabbit; mountain and river, east of lake Evans, Abitibi territory, Que.

Rabbitt; mount, also creek, northwest of Tulameen, Yale district, B.C.

Race; passage and rocks, off S. point of Vancouver island, B.C. (Not Race islands.)

Rae; mount, Misty range, southern Alberta.

Raft; narrows, north of Hill island, St. Lawrence river, Leeds county, Ont.

Ragged; bight, northeast of cape Hurd, Bruce county, Ont.

Ragged Island (harbour). See Lockeport.

Ragged; lake, in the Algonquin National park, Nipissing district, Ont.

Ragged; mountain, east of Sooke river, Vancouver island, B.C. (Not Saddle.)

Ragged. See Locke.

Rainy; creek, tributary to Elbow river, Alberta.

Rainy; creek, tributary to Moyie river, Kootenay district, B.C.

Rainy; lake and river, international boundary, Rainy River district, Ont.

The river takes its name from the lake which appears on early maps as "Tekamammaouen"—written "Tekamaihouenne" by Verendry 1738, and also as lac la Pluie (probably derived from the Indian name) and not as erroneously supposed from René, "name of its discoverer," nor from reine "meaning Queen of rivers."

Raisin; river, Glengarry and Stormont counties, Ont. (Not Black R., R. au Raisin, nor Riv. aux Raisins.)

Raley; point, north of Clio bay, Kitimat arm, Coast district, B.C.

Ram; creek, flowing northeasterly into Saskatchewan river, Alta. (Not Sheep river.)

Ramsay; river, emptying into Crooks inlet, north shore of Hudson strait, N.W.T.

Ramsden; island, Lake Fleet group, St. Lawrence river, Leeds county, Ont.

Ranch; point, Nanoose harbour, east coast of Vancouver island, B.C.

Randolph; lake, S. of N. T. Ry. and N.W. of L. Nipigon, Thunder Bay district, Ont.

Rapid. See Broadback.

Rapid. See Minnedosa.

Rapid. See Montreal.

Rapide-de-Femme; post village, Victoria county, N.B. (Not Rapid de Femme nor Rapide des Femmes.)

Rapides (lac des); lake, upper Ottawa R., southeast of Barriere L., Pontiac Co., Que.

Rapid River (lake). See Forks.

Raquette; river, Vaudreuil county, Que.

Raspberry. See Robinson.

Rat; lake, between Rose and South lakes, Int. boundary, Thunder Bay district, Ont.

Rat. See Alcott.

Rat. See Taggart.

Rathbun; bay and point, E. of Jenkins Pt., Manitoulin I., Manitoulin district, Ont.

Rat Portage. See Kenora.

Rat Portage (lake). See Manigotagan.

Rattlesnake. See Bagot.

Ravelin; mountain, northwest of Mt. Sir Sandford, Selkirk mountains, Kootenay district, B.C.

Raven; lake and river, McFadden township, Timiskaming district, Ont.

Raven; river, tributary to Red Deer river, southern Alberta.

Rawson; harbour and island, N. shore Hudson strait N.W.T. (Not Harbour island.)

Raymond; passage, S. from Seaforth Ch., Coast district, B.C. (Not Hecate channel.)

Reader; lake, northwest of Pas, Manitoba. (Not Clear Water nor Reeder.)

Reception; lake, Grasett township, Algoma district, Ont. (Not Kaikaquabick.)

Red; bay, south of Golden valley, Bruce county, Ont.

Red; lake, northwest of L. Seul, Patricia district, Ont. (Not Vermilion.)

Red. See McKay.

Redan; mountain, northwest of Sir Sandford range, Selkirk Mts., Kootenay dist., B.C.

Redberry; lake, southwest of Carlton, central Saskatchewan.

Redburn; creek and peak, northeast of Moberly, Rocky Mts., Kootenay district, B.C.

Red Dan; reef, southeast of Birch point, Manitoulin island, Manitoulin district, Ont.

Red Deer; lake, and river emptying into lake Winnipegosis, Sask.

Red Deer; river, also town on the river, southern Alberta.

Red Deer. See La Biche.

Red Deer. See Waskesiu.

Red Deer (lakes). See Anerley, Coteau, Stockwell.

Redding; creek, tributary to St. Mary river, Kootenay district, B.C.

Redflag; mountain, west of Parry bay, Vancouver island, B.C.

Redhorse; rock and lightstation, west of Beaurivage island, Admiralty group, St. Lawrence river, Leeds county, Ont. (Not 7a.)

Rednersville; village, Ameliasburg township, Prince Edward county, Ont.

Redoubt; lake and mountain, northeast of Laggan, Rocky mountains, Alberta.

Redstone; brook and lake, Guilford township, Haliburton county, Ont.

Redwater; river, flowing southeasterly into the Saskatchewan, below Sturgeon river, Alberta. (Not Red Water.)

Reed; lake, northeast of Cormorant lake, Manitoba.

Reed. See Perch.

Reed. See Reid.

Reeder. See Reader.

Reef. See Bonnet.

Reesor; lake, Whitchurch township, York county, Ont. (Not Middletons.)

Reeves; harbour, Big island, Hudson strait, N.W.T.

Refuge; cove, east of Shipwreck point, Kings county, P.E.I. (Not Naufrage.)

Refugee. See Conran.

Refugee. See Stovin.

Reid; island, south of Valdes island, southeast coast of Vancouver island, B.C.

Reid Mills; post office, Dundas county, Ont. (Not Reid's Mills.)

Reid; mount, between Watson and Wheaton rivers, southern Yukon.

Reid; mount, southeast of lake Evans, Abitibi territory, Que.

Reid; point, south of Red bay, Bruce county, Ont.

Reid; rock, south of George island, Halifax harbour, Halifax Co., N.S. (Not Reed.)

Reindeer; creek, tributary to Yukon river, south of Indian river, Yukon.

Reindeer; lake and river, emptying into Churchill river, Manitoba and Sask.

Reindeer. See Punk.

Remic; rapids, in Ottawa river, about two miles west of Ottawa city. (Not Remicks, Remix, nor Remous.)

Remington; creek, tributary to Indian river, Yukon.

Remous. See Remic.

Renny; island, south of Whitney point, St. Lawrence R. Leeds Co., Ont. (Not Bush.)

Reservation. See Paul.

Reserve; point, Active pass, strait of Georgia, Westminster district, B.C.

Resolution; island, at entrance to Frobisher bay, N.W.T. (Not Tudjakdjuan.)

Resolution. See Warwick.

Rest. See Dufay.

Restigouche; county and river, northern New Brunswick. (Not Ristigouche.)

Restigouche. See Ristigouche.

Retreat; cove, southwest of Galiano island, strait of Georgia, B.C.

Revelstoke; mount, railway station, and town, Kootenay district, B.C.

Rexton; town, Kent county, N.B. (Not Kingston.)

Riall; island, Brock group, St. Lawrence R. Leeds Co., Ont. (Not Millar's nor Smith's.)

Rib; lake, north of Cassels township, Timiskaming district, Ont.

Ribbon; river, tributary to Manuan river, upper St. Maurice, Champlain county, Que. (Not Rivière au Ruban.)

Ribstone; creek, tributary to Battle river, eastern Alberta. (Not Nose.)

Rice. See Muldrew.

Rich; island, Navy group, St. Lawrence river, Leeds county, Ont.

Richard; point, Nanoose harbour, east coast of Vancouver island, B.C.

Richard; point, north of "The Narrows," L. Manitoba, Man.

Richards; mount, southwest of Osborn bay, Stuart channel, Vancouver island, B.C.

Richardson; lake and river emptying into the Athabaska near its mouth, Alberta.

Richardson; mount, northeast of Laggan, Rocky mountains, Alberta.

Richelieu; village, on Richelieu river, Rouville county, Que. (Not Village Richelieu.)

Richmond; gulf, north of Little Whale river, New Quebec. (Not Richmond lake.)

Richmond; village, Carleton county, N.B. (Not Richmond Corner.)

Richmond. See Malpeque.

Richmond. See New Richmond.

Richmond Corner. See Richmond.

Richthofen; island and valley, lake Laberge, Yukon. (Not Richtofen.)

Rickett; harbour, eastern side of Cockburn island and southwesterly from Cinder point, Manitoulin district, Ont.

Rickley; harbour, W. of Burnt I., and N. of Western Duck I., Manitoulin dist., Ont.

Riddell; mount, also creek, northwest of Tulameen, Yale district, B.C.

Riddell; mount, between Macmillan and Ross rivers, also river tributary to the Macmillan, Yukon.

Ridgeway; creek, tributary to Moyie river, Kootenay district, B.C.

Riding; mountain, western Manitoba.

Ridley; island, south of Kaien island, Chatham sound, Coast district, B.C. (Not Flat nor North Porpoise.)

Rigaud; river, a small tributary of the Ottawa river, Glengarry and Prescott counties, Ont. and Vaudreuil county, Que. (Not rivière à la Graisse.)

Right Hand Branch, (Tobique R). See Campbell.

Rigolet; settlement, at narrows of Hamilton inlet, Ashuanipi territory, Que. (Not Rigoulette.)

Riley; brook, tributary to Tobique river, Victoria county, N.B.

Rinda; a spur of the Valhalla mountains, Kootenay district, B.C.

Ringnes; islands, southwest of Axel Heiberg island, N.W.T.

Rink; rapid, in Lewes river, below Tatchun river, Yukon.

Riordon; point, Boxer reach, Coast district, B.C.

Rip; point, Active pass, strait of Georgia, New Westminster district, B.C.

Ripple; reef, west of Lyal island, Bruce county, Ont.

Ripple. See Hawkins.

Riske; creek, trib. to Fraser R., above Chilcotin R., Cariboo and Lillooet dists., B.C.

Ristigouche; township, Bonaventure county, Que. (Not Restigouche.)

Ristigouche. See Restigouche.

Ritchie; point, north extreme of Kaien island, Coast district, B.C. (Not Hays.)

River Beaudette. See Beaudet.

River Denys. See Denys.

River (mountain). See Lewes.

Rivers; lake of the, southern Saskatchewan.

Rivière-à-la-Martre; post village, also Light, Signal and Telegraph station, Christie township, Gaspe county, Que. (Not Martin River nor Rivière à la Marte.)

Rivière-à-Pierre; parish and village, Portneuf county, Que. (Not Rivière à Pierre.) See also Pierre (rivière à.)

Rivière-des-Caches; village, Northumberland county, N.B. (Not River de Cache nor Rivière du Cache.)

Rivière-des-Chûtes; village, Carleton county, N.B. (Not River de Chute.)

Rivière-des-Fèves; post office, Chateauguay county, Que. (Not Rivières des Fèves.)

Rivière-des-Prairies; village, Hochelaga county, Que. (Not Rivière des Prairies.) See also Prairies.

Rivière-du-Loup; post office and railway station, Temiscouata county, Que.

Rixon; rock, near North point, at entrance to Georgian bay, Manitoulin district, Ont.

Roach. See Roche.

Roaring; river, tributary to Swan river, western Manitoba. (Not Rolling.)

Roberson; point, northeast coast of Digby island, Coast district, B.C.

Robert; island, northeast of Grenadier island, St. Lawrence river, Leeds county, Ont. (Not Cherry nor Sumac.)

Robert; lake, Martin river, above Tesckau lake, Mistassini territory, Que.

Robert; point, Markham bay, Hudson strait, N.W.T.

Roberts; bay, in South bay, Manitoulin island, Manitoulin district, Ont.

Robertson; cove, north of Lizard islands, Manitoulin district, Ont. (Not Jackson.)

Robertson; creek, tributary to Little Slocan river, Kootenay district, B.C.

Robertson; lakes, Privat township, Timiskaming county, Que.

Robertson; mount, near Stikine river, north of Iskut river, Cassiar district, B.C.

Robertson; post office and railway station, Megantic county, Que. (Not Robertson Station post office.)

Robertson Station. See Robertson.

Robinson; cove, Big island, bay of Quinte, Prince Edward county, Ont.

Robinson; island, S. of Whitney Pt., St. Lawrence R., Leeds Co., Ont. (Not Raspberry.)

Robinson; lake and river, S. of N. T. Ry., N.E. of L. Nipigon, Thunder Bay dist., Ont.

Robinson; sound, northeast of Cornell Grinnell bay, N.W.T. (Not Robinson's.)

Rob Roy; creek, tributary to Dominion creek, Indian river, Yukon.

Robson; mount, north of the east fork of Fraser river, Cariboo district, B.C.

Robson; pass, north of mount Robson, Rocky mountains, Cariboo district, B.C.

Robson; town and railway station, on Columbia river, Kootenay district, B.C.

Roche; lake, Tp. 17, R. 16, W. 6 M., Yale district, B.C. (Not Roach.)

Roche à Veillons. See Algernon.

Roche de Smet; west of Jasper lake, western Alberta. (Not Roche Suette.)

Rochelle; post office, Shefford county, Que. (Not Ste. Anne-de-Stukely.)

Roche Percée; railway station, southeastern Saskatchewan. (Not Roche Percé.)

Roche-Percée; reef, St. Lawrence river, opposite Cacouna, Temiscouata county, Que.

Rocher Déboulé; mountains, south of Hazelton, Cassiar district, B.C. (Not Rochers Déboulés.) Previous decision revised.

Rochers (pointe des); point, below cape Salmon, Charlevoix county, Que.

Roche Suette. See Roche de Smet.

Rock; lake, Nightingale township, Haliburton county, Ont.

Rock. See Kikomun.

Rock. See Lazy.

Rockcliffe; police village, Carleton county, Ont. (Not Rockliffe.)

Rockliffe. See Stonecliff.

Rocksprings; post office, Leeds county, Ont. (Not Rock Springs.)

Rocky. See Descanso.

Rocky. See Opabin.

Rocky. See Tinson.

Roes Welcome; sound, in the northwestern portion of Hudson bay, N.W.T. (Not Rowe's Welcome nor Sir Thomas Rowe's Welcome.)

Roger; lake, northwest of Expanse lake, Timiskaming county, Que. (Not Rogers.)

Rogers; glacier, pass, and peak, and Rogers Pass railway station, Selkirk mountains, Kootenay district, B.C.

Rogers. See Prim.

Rogersville; parish, Northumberland county, N.B. (Not Rogerville.)

Roggan; river, emptying into James bay, New Quebec. (Not Bishop Roggan nor Great Bishop Roggan.)

Rogue; river, tributary to Hess river, Yukon.

Rolleston; island, northwest of Grenadier I., St. Lawrence river, Leeds county, Ont.

Rolling. See Roaring.

Rollingdam; village, Charlotte county, N.B. (Not Rolling Dam.)

Rolph; creek, tributary to St. Mary river, southern Alberta.

Romaine; river, lower St. Lawrence, opposite Mingan islands, Saguenay Co., Que.

Rond (cap); cape, east end of Madame island, Richmond county, N.S. (Not La Ronde nor Round.)

Rondeau; harbour, park, and Ry. station, on L. Erie, Kent Co., Ont. (Not Rond Eau.)

Root; river, flowing southwesterly into L. Seul, Patricia district, Ont.

Root. See Carrot.

Rosamond; lake, N.W. of Rugby township, Kenora district, Ont. (Not Rosamund.)

Rose; island, between Broughton and Robert islands, St. Lawrence river, Leeds county, Ont. (Not Grape nor Grass.)

Rose; lake, on international boundary, Thunder Bay district, Ont. (Not Mud.)

Rose; lake and river, at headwaters of Nisutlin river, Yukon.

Rose; pass, at head of St. Mary river, Kootenay district, B.C.

Roseau; river, flowing westerly into Red river, southeastern Manitoba.

Rosebud; creek, tributary to Stewart river, Yukon.

Rosebud; river, tributary to Red Deer river, Alberta. (Not Arrowhead.)

Rosenfeld; rock, northeasterly from the east point of Saturna island, strait of Georgia, New Westminster district, B.C. (Not Rosenfelt.)

Roseville; village, Prince Co., P.E.I. (Not Little or S. Mimingash nor Minimegash.)

Ross; creek, flowing into the S. Saskatchewan at Medicine Hat, Alberta.

Ross; island, between the east and west channels of Nelson river, Manitoba.

Ross; isthmus and peninsula, northwesterly portion of Franklin isthmus, N.W.T. (Not James Ross.)

Ross; lake, south of Stephen station, Kootenay district, B.C.

Ross; lake, northwest of Affleck lake, Kenora district, Ont.

Ross; peak, Selkirk mountains, Kootenay district, B.C.

Ross; river, tributary to Pelly river, Yukon.

Rossmore; village, Ameliasburg township, Prince Edward county, Ont.

Rouge; lake, Wolfe township, Terrebonne county, Que. (Not lac de la Rouge.)

Rouge; river, flowing into lake Ontario, Ontario and York counties, Ont. (Not Rouge creek nor Big Rouge creek.)

Rough; island, northeast of Grenadier island, St. Lawrence river, Leeds county, Ont (Not Hamilton nor Little.)

Rougie. See Salisbury.

Round; lake, on Qu'appelle river, southeastern Saskatchewan.

Round. See Campbell.

Round. See Felice.

Round. See Francis.

Round. See Ghost.

Round. See Joubert.

Round. See Lacroix.

Round. See Rond.

Round. See Skelton.

Rousseau. See Arosen.

Rousselet; island, at the north end of lake Timiskaming, Ont.

Roussin. See Arosen.

Route; lake, west of Asheigamo lake, Kenora district, Ont.

Routhier; lake, Rouyn township, Timiskaming county, Que. (Not Rush.)

Rouville. See St. Hilaire.

Rouyn; lake, Rouyn township, Timiskaming county, Que. (Not Stewart.)

Rove. See Watap.

Rowan; lake, northeast of Kakagi lake, Kenora district, Ont.

Rowe; island, northerly one of Lizard group, Algoma district, Ont. (Not N. Lizard.)

Rowes. See Roes.

Rowley; island, Navy group, St. Lawrence river, Leeds county, Ont.

Rowlinson; creek, tributary to Nordenskiöld river, Yukon.
Roxburg; post settlement, Albert county, N.B. (Not Roxborough.)
Roxton East; post office, Shefford county, Que.
Royal; island, Brock group, St. Lawrence river, Leeds county, Ont. (Not Bathing.)
Royal; roads, south of Esquimalt harbour, Vancouver island, B.C. (Not Royal bay.)
Royal George. See Myles.
Ruban. See Ribbon.
Ruby; creek, tributary to Indian river, Yukon.
Ruby; creek and mountain, west of Surprise lake, Cassiar district, B.C.
Ruby; mountain, E. of Columbia R., between the Arrow lakes, Kootenay district, B.C.
Rudyard; reef, west of Queen point, Manitoulin island, Manitoulin district, Ont.
Ruel; shoal, southwest of Dead island, at entrance to Key harbour, Georgian bay, Parry Sound district, Ont.
Rugged. See Locke.
Rugged Island (harbour). See Lockeport.
Rundle; mount, between Bow and Spray rivers, Rocky Mountains park, Alberta.
Rupert; bay and river, Mistassini, Que. Rupert House, H. B. Co., at mouth of river.
Rusagonis; river and village, Sunbury Co., N.B. (Not Rusagornis nor Rushagornis.)
Ruscom; post village, railway station, and river, Essex county, Ont. (Not Ruscomb river and village, nor Ruscom Station.)
Rush. See Routhier.
Rushagornis. See Rusagonis.
Russel; creek, tributary to Little Slocan river, Kootenay district, B.C.
Russel; island and reef, S.E. of Cove I., at entrance to Georgian Bay, Bruce Co., Ont.
Russell; arm and point, northwest side of Prince Rupert harbour, Coast district, B.C.
Ruth; island, Nanoose harbour, east coast of Vancouver island, B.C.
Ruth; lake and river, W. of Nakina R., and S. of Chikoida Mt., Cassiar district, B.C.
Ryckman; post village, Wentworth county, Ont. (Not Ryckman's Corners.)
Rykerts. See Bedlington.

S

Saanich; inlet, southeast coast of Vancouver island, B.C.
Saanichton; bay and Ry. station, S.E. coast of Vancouver I. B.C. (Not Cordova bay.) To avoid duplication of "Cordova" applied to a large bay to the south.
Sable; river, southeast of Chiefs point, Bruce county, Ont.
Sable. See Ausable.
Sachigo; lake, and river tributary to Severn river, Patricia, Ont. (Not Achigo.)
Sackawatisi. See Sassawatisi.
Sacré-Cœur-de-Marie; post village, Thetford township, Megantic county, Que. (Not Sacré-Cœur de Marie.)
Saddle; hill, south of Satellite channel, Vancouver island, B.C. (Not Arbutus.)
Saddle; lake, also Saddle Lake post office, eastern Alberta.
Saddle; mountain, near confluence of Stikine and Anuk rivers, Cassiar district, B.C.
Saddle; mountain, southeast of Fairview mountain, Alberta. (Not 'The Saddle.')
Saddle. See Ragged.

Saddleback; island, northwest of Pritzler harbour, Hudson strait, N.W.T.

Sagaminnis; lake, southwest of Wapikopa lake, upper Winisk river, Patricia, Ont.

Saganaga; lake, on international boundary, Rainy River and Thunder Bay districts, Ont. (Not Seiganagah, Seiganagan, nor Seiganagaw.)

Saganaga. See Boyer.

Sagemace; bay, in southern portion of lake Winnipegosis, Manitoba.

Sahpoochaway. See Odei.

Sah-wah-mish-she. See Sawamisshe.

Sain; cape, above Pointe-au-Pic, Charlevoix county, Que.

Ste. Agnès-de-Dundee; post office, Huntington county, Que. (Not Ste. Agnès nor Ste. Agnès de Dundee.)

St. Alexandre; parish and railway station, also St. Alexandre Station post office, Iberville county, Que. (Not St. Alexander.)

St. Alphonse-de-Granby; village, Shefford Co., Que. (Not St. Alphonse de Granby.)

St. André; bank, parish, point, and village, Kamouraska county, Que.

St. André-de-Ristigouche; post office, Ristigouche township, Bonaventure county, Que. (Not St. André de Restigouche.)

St. Andrew; channel, southeast of Boularderie island, Cape Breton and Victoria counties, N.S.

St. Andrew; lake, in Tps. 31 and 32, R. 1 E.P.M., Manitoba. (Not Long.)

St. Andrews; post village, Stormont county, Ont. (Not St. Andrews West.)

St. Andrews; town, Charlotte county, N.B. (Not St. Andrew's.)

St. Andrews; village, Argenteuil county, Que. (Not St. Andrews East.)

Ste. Angèle-de-Rimouski; village, Matane county, Que. (Not Ste. Angele de Mercie.)

St. Ann; bay, harbour, and village, Victoria county, N.S.

St. Ann; lake, central Alberta.

St. Ann; village, Lincoln county, Ont. (Not St. Anne nor St. Ann's.)

St. Anne; island, at the mouth of St. Clair river, Lambton county, Ont. (Not St. Anne's nor St. Ann's.)

Ste. Anne-de-Bellevue; village, Jacques Cartier county, Que. (Not Ste Anne de Bellevue nor Ste. Anne du bout de L'Ile.)

Ste. Anne-des-Monts; village, Gaspe county, Que. (Not Ste. Anne de Monts.)

Ste. Anne-de-Stukely. See Rochelle.

Ste. Anne du bout de L'Ile. See Ste. Anne-de-Bellevue.

St. Anthony; lake, Skead township, Timiskaming district, Ont.

St. Antoine-de-Pontbriand; village, Thetford township, Megantic county, Que. (Not St. Antoine de Pontbriand.)

St. Antoine-de-Tilly; village, Lotbinière county, Que. (Not St. Antoine, Lotbinière.)

St. Antoine, Lotbinière. See St. Antoine-de-Tilly.

St. Augustin; river, flowing southerly into the gulf of St. Lawrence, Saguenay county, Que. (Not St. Augustine.) Decision based on priority of publication.

St. Barnabé-rivière-Yamaska; post settlement and railway station, St. Hyacinthe county, Que. (Not St. Barnabé, river Yamaska.)

St. Basile-de-Portneuf; parish and post village, Portneuf county, Que. (Not St. Bazile de Portneuf.)

St. Bernard-Sud; post office, St. Johns Co., Que. (Not St. Bernard nor St. Bernard S.)

Ste. Brigide; village and Ry. station, Iberville Co., Que. (Not Ste. Brigide d'Iberville.)

St. Casimir; parish, railway station, and village, Portneuf county, Que.

St. Catharines; city, Lincoln county, Ont. (Not St. Catherines.)

Ste. Cécile-de-Milton; village, Shefford county, Que.

St. Charles-de-Caplan; village, Bonaventure county, Que. (Not St. Charles Caplin.)

St. Clair; lake and river, Essex, Kent and Lambton counties, Ont.

St. Columban; village, Two Mountains Co., Que. (Not St. Colomban nor St. Columbin.)

St. Croix; lake, Hants county, N.S. (Not St. Croix River lake.)

St. Croix. See Ponhook.

Saint-Cyr; mount, north of Quiet lake, Yukon.

St. David; lake, in Tps. 31 and 32, R. 1, W. P. M., Manitoba.

St. David; village, Lincoln county, Ont. (Not St. David's.)

St. Denis; cove, parish, point, and village, Kamouraska county, Que. (Not St. Denis de la Bouteillerie village.)

St. Dominique-de-Bagot; post village, Bagot Co., Que. (Not St. Dominique de Bagot.)

Ste. Edwidge; post village, Clifton township, Compton county, Que. (Not St. Edwidge.)

Ste. Emelie. See Ste Emmélie.

Ste. Emilie. See Ste. Emmélie.

Ste. Emmélie; parish and village, Lotbinière Co., Q. (Not Ste. Emelie nor Ste. Emilie.)

St. Etienne; parish, Charlevoix county, Que.

St. Etienne-de-Beauharnois; post village, Beauharnois county, Que. (Not St. Etienne nor St. Etienne de Beauharnois.)

St. Eugene; mission, on St. Mary river, Kootenay district, B.C.

St. Eugène-de-Guigues; post office, Guigues township, Timiskaming county, Que. (Not Ste. Eugene de Guigues.)

St. Fidèle; post settlement, Charlevoix county, Que.

Ste. Foy; parish and post village, Quebec county, Que. (Not St. Foy.)

St. Francis; lake, Frontenac county, and river flowing from the lake, through the counties of Wolfe, Compton, Sherbrooke, Richmond, Drummond, and Yamaska, emptying into the St. Lawrence at lake St. Peter, Que. French form, St. François.

Ste. Geneviève; group of islands, E. of Ste. Anne-de-Bellevue, Jacques Cartier Co., Que.

St. George; cape, St. Peter's inlet, Richmond county, N.S. (Not George.) To distinguish it from Cape George in Antigonish county.

St. George; lake, Tps. 31-2-3, R. 1 E. and Tp. 31, R. 1 W. P.M., Man. (Not. St. George's.)

St. George Port Daniel. See Port Daniel.

St. Germain; parish and village, Kamouraska county, Que.

St. Grégoire. See Mount Johnson.

St. Hector; post office, Bagot county, Que. (Not St. Hector de Bagot.)

St. Hector de Bagot. See St. Hector.

St. Helen; island, in the St. Lawrence, near Montreal, Hochelaga county, Que. (Not St. Helen's.) French usage, Ste. Hélène.

St. Helena; island, northeast of Grenadier island, St. Lawrence river, Leeds county, Ont. (Not Cherry nor Goulbourne.)

Ste. Hélène-de-Bagot; post village and railway station, Bagot county, Que. (Not Ste. Hélène de Bagot.)

St. Henri; post village, Lévis county, Que. (Not St. Henri Station.)

St. Henri Station. See St. Henri.

St. Hilaire; mountain, near St. Hilaire, Rouville county, Que. (Not Belœil nor Rouville.)

St. Hilary; mount, southeast of Braeburn lake, southern Yukon.

St. Irénée; parish and post village, Charlevoix county, Que.

St. Jean Deschaillons. See Deschaillons.

St. Joachim; post village and railway station, Essex county, Ont. (Not St. Joachim River Ruscom.)

St. Joachim-de-Shefford; post village, Shefford Co., Que. (Not St. Joachim de Shefford.)

St. John; creek and ridge, west of Beaverdell creek, Similkameen district, B.C.

St. John; island, Melville lake, Ashuanipi territory, Que. (Not St. Johns.)

St. John; mount, southwest of Windigo bay, L. Nipigon, Thunder Bay district, Ont.

St. Johns; county and town, on Richelieu river, Que. (Not St. John's.)

St. Joseph; village, south of Goderich, Huron county, Ont.

St. Joseph d'Orleans. See Orleans.

St. Joseph-de-St.-Hyacinthe; post village, St. Hyacinthe county, Que. (Not St. Joseph de St. Hyacinthe.)

St. Lambert; village, Chambly county, Que. (Not St. Lambert, Chambly.)

St. Laurent; village, Jacques Cartier county, Que. (Not St. Laurent, Montreal.)

St. Laurent, Montreal. See St. Laurent.

St. Lawrence; island, Lake Fleet group, St. Lawrence river, Leeds county, Ont.

St. Louis-de-Chambord; parish, Lake St. John county, Que.

St. Marc-des-Carrières; village, Portneuf county, Que. (Not St. Marc des Carrières.)

St. Margaret; bay, Halifax county, N.S. (Not St. Margaret's.)

Ste. Marguerite; river, tributary to Saguenay river, Chicoutimi and Saguenay counties, Que. (Not St. Margaret.)

Ste. Marguerite. See Marguerite.

St. Martin; lake, northeast of lake Manitoba, Man. (Not St. Martin's.)

St. Martin. See Martin.

St. Martins; lightstation, parish, railway station, and village, St. John county, N.B. (Not Quaco, nor St. Martin's P.O.)

St. Mary; bay and cape, Digby county, N.S.

St. Mary; lake, Saltspring island, southeast coast of Vancouver island, B.C.

St. Mary; lake, Ridout township, Muskoka district, Ont.

St. Mary; lake and river tributary to Kootenay river, B.C. (Not Torrent.)

St. Mary; post village, Kent county, N.B.

St. Mary; river, joining lakes Huron and Superior, international boundary line between Canada and United States. (Not St. Mary's.)

The narrows between Point Iroquois and Gros cap is to be considered the head of the river, and that between Old Fort St. Joe and Sweet point the mouth

of the south branch. The north branch, passing through East Neebish rapids, also carries the name of the river, through St. Joseph channel, to the narrows between Bowker point and Gravel point.

St. Mary; river, Guysborough county, N.S.

St. Mary; river, tributary to Belly river, southern Alberta. (Not St. Mary's.)

St. Marys; town and railway station, Perth county, Ont. (Not St. Mary's.)

St. Maurice; county and river, Que.

St. Michel-de-Rougemont; village, Rouville Co., Q. (Not St. Michel de Rougemont.)

Ste. Monique; post office, Two Mountains county, Que. (Not Ste. Monique des Deux Montagnes.)

Ste. Monique des Deux Montagne. See St. Monique.

St. Nicholas; peak, north of mount Gordon, Rocky mountains, Alberta.

St. Nora; lake, Stanhope township, Haliburton county, Ont. (Not St. Nora's.)

St. Onge; post office, near Embrun, Russell county, Ont.

St. Pamphile; village, L'Islet county, Que.

St. Patrick; channel, an arm opening to the westward from Great Bras d'Or, Inverness and Victoria counties, N.S.

St. Patrick; lake, in Tps. 32 and 33, R. 1, E. and W. P. M., Manitoba.

St. Patrick's. See San Josef.

St. Paul; post village, Kent county, N.B. (Not St. Pauls.)

St. Paul. See Nuns.

St. Paul-du-Buton; parish and post office, Montmagny county, Que. (Not St. Paul de Buton.)

St. Paul's Bay. See Baie-St.-Paul

Ste. Perpétue; village, Argenteuil county, Que.

St. Peter; bay, river, and railway station, Kings county, P.E.I. (Not St. Peter's nor Head of St. Peter's bay.)

St. Peter; island, Hillsborough bay, Queens county, P.E.I. (Not St. Peter's.)

St. Pierre-les-Becquets; parish and post office, Nicolet county, Que. (Not St. Pierre des Becquets nor St. Pierre les Bequets.)

St. Piran; mount, west of Laggan station, Alberta.

St. Raphael; post village, Glengarry Co., Ont. (Not St. Rafael nor St. Raphael West.)

St. Regis; post office, Huntingdon county, Que. (Not St. Régis.)

St. Roch-des-Aulnaies; village, L'Islet county, Que. (Not St. Roch des Aulnets.)

Ste. Rosalie; island, in Ottawa river, near Montebello, Ottawa county, Que.

St. Siméon; parish and village, Charlevoix county, Que.

St. Simon-de-Yamaska; post village and railway station, Bagot county, Que. (Not St. Simon d'Yamaska.)

St. Sixte; lake, and river trib. to Petite Nation R. Ottawa Co., Que. (Not Sincique.)

St. Stanislas-de-Kostka; post village, Beauharnois county, Que. (Not St. Stanislas.)

St. Stephen; town, Charlotte county, N.B. (Not St. Stephens.)

St. Théodore-d'Acton; post village, Bagot county, Que.

Ste. Thérèse-de-Blainville; village and railway station, Terrebonne county, Que. (Not Ste. Thérèse nor Ste. Thérèse de Blainville.)

St. Urbain-de-Chateauguay; parish and post village, Chateauguay county, Que. (Not St. Urbain de Chateauguay nor St. Urbain en haut.)

St. Valentin; parish and post village, St. Johns county, Que. (Not St. Valentine.)

Sakwatamau; river, tributary to Athabaska R., Alta. (Not Eagle nor Sa-kwa-ta-mow.)

Salem; post village, Cumberland county, N.S. (Not Salent.)

Salent. See Salem.

Salisbury; bay, Albert county, N.B. (Not Rougie.)

Salmon; arm, southerly portion of Shuswap lake, also river emptying into the arm from the south, Kamloops district, B.C.

Salmon Arm; post settlement and railway station, on Salmon arm of Shuswap lake, Kamloops district, B.C.

Salmon; cape, above Pte. des Rochers, Charlevoix county, Que. French usage Saumon (cap au), which see.

Salmon; island, north side of Big bay, Hastings county, Ont.

Salmon; river flowing into Big bay, Hastings and Lennox counties, Ont.

Salmon. See Kinonge.

Salmon. See Wicked.

Salt; point, Presqu'ile peninsula, Brighton township, Northumberland county, Ont.

Salt. See Way.

Saltspring; island, southeast coast of Vancouver I., B.C. (Not Admiral nor Chuan.)

Salvus; railway station, north shore of Skeena river, Coast district, B.C.

Samson; peak, north of the narrows of Maligne lake, Rocky Mts., western Alberta.

Sand; bay, outlet of Rainy lake, international boundary, Rainy River district, Ont.

Sand; creek, tributary to Kootenay river, Kootenay district, B.C.

Sand. See Desert.

Sand. See Hyndman.

Sanderson; point, west side of Lower Arrow lake, Kootenay district, B.C.

Sanderson. See Iononoaklin.

Sand Point; lake, southeast of Namakan L., Int. boundary, Rainy River district, Ont.

Sandy. See Pakwa.

Sandy-beach; lake, at headwaters of St. Maurice river, Champlain county, Que.

Sanford; mount, southwest of Snowdon range, Cassiar district, B.C.

Sangrida; peak, Valkyr mountains, Kootenay district, B.C.

San Josef; bay, near N.W. end Vancouver I., B.C. (Not San Joseph nor St. Patrick's.)

San Juan; river, flowing into Juan de Fuca strait, Vancouver island, B.C.

San Miguel; group of islands, off the entrance to Friendly cove, Nootka sound, Vancouver island, B.C.

Sansum; narrows, between Saltspring and Vancouver islands, B.C.

Sapasook. See Sapasuk.

Sapasoose. See Sapasuk

Sapasuk; lake on N. T. Ry. northeast of L. Nipigon, Thunder Bay district, Ont. (Not Sapasook nor Sapasoose.)

Sapphire; col, between, "The Dome" and "Castor," Selkirk Mts., Kootenay dist., B.C.

Sarbach; mount, north of Howse pass, Rocky mountains, Kootenay district, B.C.

Sarcee; butte and Indian reserve, on Elbow river, Alberta.

Sasaginaga; lake, northwest of Cobalt, Timiskaming district, Ont. (Not Clear.)

Sasakwei; lake, southwest of Peake lake, Kenora district, Ont. (Not Summit.)

Saskatchewan; mount, south of mount Athabaska, Rocky mountains, Alberta.

Saskatchewan. See Turnagain.

Saskeram; lake, west of Pas, Manitoba. (Not Indian Pear Island lake.)

Sass; river, trib. to Little Buffalo R., S. of Great Slave L., N.W.T. (Not Sass-tessi.)

Sassaganaga; lake, northeast of Kipawa lake, Pontiac county, Que.

Sassawatisi; lake, at headwaters of Manuan river, Champlain county, Que. (Not Sackawatesie nor Chisaouataisi.)

Sass-tessi. See Sass.

Satasha; lake, west of Nordenskiöld river, Yukon.

Satellite; channel. between Saltspring I. and Saanich peninsula, Vancouver I., B.C.

Saturn; rock, southwest of Greenough point, Bruce county, Ont.

Saugeen; peninsula, the northwestern portion of Bruce county, Ont.

Saugeen; river, flowing into L. Huron at Southampton,Bruce Co., Ont. (Not Saugink.)

Saugum; creek, E. of Kootenay R., N. of Steele, Kootenay dist., B.C. (Not Six-mile.)

Sault-au-Cochon; river, Saguenay county, Que. (Not Saut de Cochon.)

Saulteux; river, tributary to Lesser Slave river, Alberta. (Not Sauteur nor Sauteux.)

Saumon (cap au); cape, above Pte. des Rochers, Charlevoix county, Que. English usage (cape) Salmon, which see.

Saunders; reef, near Misery bay, Manitoulin island, Manitoulin district, Ont.

Saut de Cochon. See Sault-au-Cochon.

Saut de Mouton. See Mille Vaches.

Sauteur. See Saulteux.

Sauteux. See Saulteux.

Savage; island, northeast of Whitney point, St. Lawrence river, Leeds county, Ont.

Savage; post office, Shefford county, Que. (Not Savage's Mills.)

Savage. See Upper Savage.

Savant; lake, south of L. St. Joseph, Thunder Bay district, Ont.

Savasse Berry. See Serviceberry.

Sawamisshi; lake, Stanhope township, Haliburton Co., Ont. (Not Sah-wah-mish-she.)

Sawback; range of mountains, north of Bow river, Rocky mountains, Alberta.

Sawback; range of mountains, west of Stikine river, Cassiar district, B.C.

Sawbill. See Sheldrake.

Sawyer; pass, at head of St. Mary river, Kootenay district, B.C.

Saxon; island, south of Shute point, Bruce county, Ont.

Sayia. See Sayyea.

Sayunei; range of mountains, Gravel river, N.W.T. (Not Sayunne.)

Sayyea; creek, tributary to upper Liard river, Yukon. (Not Sayia.)

Scalping Knife; mountain, east of Columbia river, Kootenay district, B.C.

Scatari; island, off the coast of Cape Breton I., N.S. (Not Scattarie, nor Scatary.)

Scentgrass; lake, southeast of Jackfish lake, central Saskatchewan. (Not Scent Grass.)

Schaffner; mount, northwest of Mt. Biddle, Rocky mountains, Kootenay district, B.C.

Schaw. See Puslinch.

Schist; lake, northwest of Tawatinaw lake, Kenora district, Ont.

Schley Land. See Ellesmere.

Schnabel; creek, flowing into Annie lake, southern Yukon.

Schnare; point, north shore of St. Margaret bay, Halifax county, N.S. (Not Snares.)

Schnarr; lake, Melick and Redditt townships, Kenora district, Ont.

Schooner. See Miles.

Schreiber; point, north of Kaien island, Prince Rupert harbour, Coast district, B.C.

Schwatka; river, tributary to Nordenskiöld river, southern Yukon.

Scorpion; island, Lake Fleet group, St. Lawrence river, Leeds county, Ont.

Scotch Bonnet; island and lightstation, west of Wellington (Big Sandy) bay, Prince Edward county, Ont. (Not Egg island.)

Scotchie; reef, at South Baymouth, Manitoulin island, Manitoulin district, Ont.

Scotsman; bay, Kings county, N.S. (Not Scots, Scot's nor Scotsman's.)

Scott; inlet, Metlakatla bay, Coast district, B.C.

Scott; mount, east of Rabbit mountain, Abitibi territory, Que.

Scott; point, on north side of entrance to Baie du Doré, Bruce county, Ont.

Scougall; bank, southwest of Macgregor point, Bruce county, Ont.

Scout; reef and spit, southwest of Burke island, Bruce county, Ont.

Scratching. See Morris.

Scroggie; creek, tributary to Stewart river, Yukon.

Scud; river, tributary to Stikine river, Cassiar district, B.C.

Sea; lake, Murchison township, Nipissing district, Ont.

Seagram; lake, southwest of Manito lake, central Saskatchewan.

Seal; cove, at north end of Kaien island, Coast district, B.C.

Seal. See Dog.

Seal. See Tisiriuk.

Sealion; mountain, northeast of Moberly, Rocky mountains, Kootenay district, B.C.

Seals Home. See LaMotte

Seaman; reef, entrance to Wood bay, S. shore Manitoulin I., Manitoulin dist., Ont.

Seashell; rock, west of Lyal island, Bruce county, Ont.

Seaton. See Seton.

Secretary; islands, north of Saltspring island, S.E. coast of Vancouver I., B.C.

Secretary. See Donaldson.

Seechelt; inlet, north of the strait of Georgia, B.C. (Not Sechelt.)

Seed; lake, east of Carp lake, international boundary, Rainy River district, Ont.

Seeley; village, Leeds county, Ont. (Not Seeley's Bay nor Seely's Bay.)

Seepanock. See Sipanok.

Segatiga; brook, tributary to Burntwood river, Manitoba.

Seggemak; lake, southeast of Boyer lake, Kenora district, Ont. (Not Black Bird.)

Segum Sega. See Kejimkujik.

Seiganagah. See Saganaga.

Seiganagan. See Saganaga.

Seiganagaw. See Saganaga.

Sekulmun; lake, west of Aishihik lake, Yukon.

Sekwi; brook, canyon, and mountain, Gravel R., above Natla R., N.W.T.

Selby; lake, east of Anzhekumming lake, Kenora district, Ont. (Not Lynx.)

Selkirk; mount, Mitchell range, Kootenay district, B.C.

Selkirk; N. W. Mounted Police post, at the mouth of Lewis river, Yukon. The site of the old fort of the H. B. Co. is on the opposite bank. (Not Fort Selkirk.)

Selous; mount, between the forks of Macmillan river, Yukon.

Selwyn; island, west of Humboldt bay, lake Nipigon, Thunder Bay district, Ont.

Selwyn; mount, east of mount Dawson, Selkirk mountains, Kootenay district, B.C.

Selwyn; river, tributary to Yukon river, west of Lewes river, Yukon.

Semenof; hills, at confluence of Lewes and Big Salmon Rs., Yukon. (Not Semenow.)

Semiamu; bay, E. of Boundary bay, New Westminster dist., B.C. (Not Semiahmoo.)

Sentinel; mountain, Tp. 15, R. 4, W. 5 M., southern Alberta.

Sentinel; mountain, above the junction of Cline and Saskatchewan rivers, Rocky mountains, Alberta.

Separation; lake, English river, Kenora district, Ont.

Separation; point, entrance Cowichan harbour, Vancouver I., B.C. (Not Cowichan.)

Sepewesk. See Sipiwesk.

Sept-Iles. See also **Seven Islands.**

Seraph; mountain, Selkirk range, Kootenay district, B.C.

Sergent; (lac) lake, Portneuf county, Que. See also Lac-Sergent.

Serpentine; lake, Anstruther township, Peterborough county, Ont.

Serviceberry; creek, tributary to Rosebud river, Alberta. (Not Savasse Berry.)

Seseganaga; lake, east of Sturgeon lake, Thunder Bay district, Ont.

Sesikinaga; lake and river, at headwaters of Wenesaga river, Patricia, Ont.

Setidgi. See Sitidgi.

Seton; creek and lake, west of Lillooet, Lillooet district, B.C. (Not Seaton.)

Setting; lake and river, Grass river, Manitoba. (Not Net Setting nor Puke-lowogein.)

Seul (lac); lake, Kenora and Patricia districts, Ont.

Seven Acre. See Melville.

Seven Islands (Eng. usage) **Sept Iles** (Fr. usage); group of islands, bay, and H. B. Co. post, north shore of St. Lawrence river, Saguenay county, Que.

Sevenpersons; coulée and river, southwest of Medicine Hat, Alberta. (Not Seven Persons.)

Seven Pines. See Bass.

Severn; lake and river, emptying into the southerly side of Hudson bay, also H. B. Co.'s post at mouth of river, Patricia district, Ont. (Not Fort Severn Post.)

Sévigny; island, in St. Lawrence river, near Valleyfield, Soulanges county, Que. (Not Petite Ile aux Cygnes.)

Seymour; arm, northerly portion of Shuswap lake, Kamloops district, B.C.

Shabogama; lake and river, Pontiac county, Que. (Not Shabokama.)

Shabumeni; lake and river, S.W. of Cat L., Patricia district, Ont. (Not Shaboomene.)

Shad. See Shag.

Shaft; point, Departure bay, east coast of Vancouver island, B.C.

Shag; bay and head, also Shag Bay post office, Halifax county, N.S. (Not Shad.)

Shagamu; lake and river, west of Winisk river, Patricia district, Ont. (Not Shagamew nor Shakaneh.)

Shaganash; island, northeast of Pt. Magnet, Thunder Bay district, Ont.

Shakaneh. See Shagamu.

Shakes; creek, tributary to Stikine river, south of Glenora, Cassiar district B.C.

Shakespeare; island, in Nipigon lake, Thunder Bay district, Ont.

Shakwak; valley, west of Dezadeash lake, Yukon.

Shallop; creek, south side of Anticosti island, Saguenay county, Que. (Not Chaloupe river nor Jupiter creek.)

Shallow; lake, between Bernard and Tutshi lakes, Cassiar district, B.C.

Shallow. See Mennin.

Shallow. See Pakwash.

Shamattawa; river, tributary to Winisk river, Patricia district, Ont. (Not Matawa nor Sha-mat-tay-wah.)

Shames; railway station, also river tributary to Skeena river, Coast district, B.C.

Shamrock; bank, southeast of Gatacre point, Manitoulin I., Manitoulin district, Ont.

Shamus; river, emptying into Matchimanito lake, Pontiac county, Que.

Shangoina; island, east of Thunder cape, Thunder Bay district, Ont.

Shanks; lake, Tp. 1, Rge. 21, W. 4th M., southern Alberta.

Shannonville; village, Tyendinaga township, Hastings county, Ont.

Shanly; post office, Grenville county, Ont. (Not Shanley.)

Shantee. See McMahon.

Shanty. See McMahon.

Sharbau; island, at southeasterly entrance to Rivers inlet, Coast district, B.C. (Not Sharban.) Reversal of previous decision.

Sharp; lake, northwest of Cobalt, Timiskaming district, Ont.

Sharp; mount, east of mount Goodsir, Rocky mountains, Kootenay district, B.C.

Sharp. See Jack.

Sharpe; creek, flowing westerly into Bulkley river, below Moricetown, Cassiar district, B.C. (Not Boulder.)

Sharp Mountain (lake). See Elizabeth.

Shaughnessy; mount, N. of Hermit mountain, Selkirk Mts., Kootenay district, B.C.

Shaver; river, flowing easterly into Primrose lake, central Alberta and Saskatchewan.

Shawanaga; inlet, river, and township, Parry Sound district, Ont. (Not Franklin inlet nor Shawanaga bay.)

Shawatlan; lake and passage, northeast of Kaien island, Coast district, B.C. (Not Shawatlans nor Shoo-wah-tlans.)

Shawatum; mountain, north of Nepopekum creek, Yale dist., B.C. (Not Steamboat.)

Shawenegan; falls, lake, rivers, township, and village, St. Maurice county, Que. (Not Shawinigan nor Shawanegan.

Shawnigan; creek and lake, also Shawnigan Lake, post office and railway station, Vancouver island, B.C.

Sheaffe; island, Brock group, St. Lawrence river, Leeds county, Ont. (Not Black Charlie nor Brush.

Sheak. See Sheek.

Sheba; a two-peaked mountain, at forks of Gun creek, Lillooet district, B.C.

Shebeshekong; bay, also channel between Franklin island and the mainland, Parry Sound district, Ont.

Shecake; island, South bay, Manitoulin district, Ont.

Shecatica. See Shekatika.

Shedlui. See Deception.

Sheehan; lake, Halifax county, N.S. (Not Shehea.).

Sheek; island, St. Lawrence river, west of Cornwall, Stormont county, Ont. (Not Sheak, Sheek's Sheik's, Shieck, nor Shieck's.)

Sheep; lake and mountain, east of Tatonduk river, Yukon.

Sheep; river, tributary to Highwood river, southern Alberta. (Not Sheep creek.)

Sheepshank. See Shesheeb

Sheesheeb. See Shesheeb.

Sheffield Vault; brook, flowing into Minas channel, Kings county, N.S.

Shegunia; river, flowing westerly into Skeena river, above Hazelton, Cassiar district, B.C. (Not She-gun-ya.)

Shehea. See Sheehan.

Sheik's. See Sheek.

Shekatika; bay, west of the strait of Belleisle, Saguenay Co., Que. (Not Shecatica.)

Shelburne; bay, harbour, and town, Shelburne Co., N.S. (Not Shelburne Harbour.)

Shelburne Harbour. See Shelburne.

Sheldon; lake, Lutterworth township, Haliburton county, Ont. (Not Sheldon's.)

Sheldon; lake, on Ross R., also mountain between Macmillan and Ross Rivers, Yukon.

Sheldrake; river, Saguenay county, Que. (Not Sawbill.)

Shell; brook, tributary to Shell river, north of Prince Albert, Sask.

Shellbrook; post office, Sec. 16, Tp. 49, R. 3, W. 3 M., Sask. (Not Shell Brook.)

Shell; lake and river, tributary to the Saskatchewan, central Saskatchewan.

Shell; river, tributary to Assiniboine river, western Manitoba.

Shemogue; harbour and town, Westmorland Co., N.B. (Not Gr. Shemogue nor Bristol.)

Shemong. See Chemung.

Sheogomoc. See Shogomoc.

Sheol; mountain, east of mount Aberdeen, Alberta.

Shepherd; mount, north of Sooke basin, Vancouver island, B.C.

Sherbrooke; city and county, Que. (Not Sherbrook.)

Sherbrooke; creek and lake, northwest of Hector station, Kootenay district, B.C.

Sherbrooke; islands, between Garret and Lynedoch Is., St. Lawrence R., Leeds Co., Ont.

Sherbrooke; township, in Haldimand county, Ont. (Not Sherbrook.)

Sherbrooke; village in Guysborough county, N.S. (Not Sherbrook.)

Sheringham; point, west of Sooke inlet, Vancouver island, B.C. (Not Sherringham.)

Sherwood; point, Presqu'ile bay, Northumberland county, Ont. (Not Sherwood's.)

Sherwood Spring; post village, Leeds county, Ont. (Not Sherwood Springs.)

Shesheeb; bay and point, east of Black bay, Thunder Bay district, Ont. (Not Sheepshank, Sheesheeb, nor Shesheep.)

Shesheinquann. See Shoshokwan.

Sheslay; river, tributary to Inklin river, Cassiar district, B.C.

Shezal; canyon, Gravel river, below Natla river, N.W.T.

Shictahawk. See Shiktahawk.

Shieck. See Sheek.

Shields; landing, on west side of Lower Arrow lake, Kootenay district, B.C.

Shiktahawk; river, tributary to St. John river, Carleton county, N.B. (Not Shictahawk, Shikatehawk, nor Shikitihawk.)

Shingwak; lake, north of Cameron lake, Kenora district, Ont. (Not Pine.)

Shinimikas; river, flowing into Northumberland strait, Cumberland county, N.S. (Not Chinimicash, Shinemecas, Shinemakas, Shinemicas, Shinimecas nor Shinimicas.)

Ship; bank, in Owen channel, Manitoulin district, Ont.

Ship; island, N.E. from Horse point, Ameliasburg township, Prince Edward Co., Ont.

Shippigan; harbour, island and village, Gloucester county, N.B. (Not Shippegan.)

Shipwreck; point, Kings county, Prince Edward Island.

Shi-shi-shi. See Octave.

Shoal; point, in Presqu'ile bay, Brighton township, Northumberland county, Ont.

Shoe; island, northwest of Grenadier island, St. Lawrence river, Leeds county, Ont.

Shoemaker. See Ingall.

Shogomoc; lakes, and river tributary to St. John river, York county, N.B. (Not Sheogomoc nor Shogamoc.)

Sholiaban; creek and fishing station, west of Mekattina cape, Saguenay county, Que. (Not Choniaban, Souriban, nor Sourilaban.)

Shongwashu; lake, E. of Boyer L., Kenora dist., Ont. (Not Shongwashoucheneibwin.)

Shookum. See Skookum.

Shoo-wah-tlans. See Shawatlan.

Shoshokwan; lake, and river tributary to upper Ottawa river, Montcalm and Pontiac counties, Que. (Not Shoshoquon nor Shesheinquann.)

Shotbolts. See Gonzales.

Shoulie. See Shulie.

Shoushwap. See Shuswap.

Shubenacadie; lake, Halifax and Hants counties, N.S. (Not Grand nor Shubenacadie Grand.)

Shulaps; mountain, between the forks of Bridge river, Lillooet district, B.C.

Shulie; river and village, Cumberland county, N.S. (Not Shoulie.)

Shunda; creek, flowing southeasterly enters the Saskatchewan in Tp. 40, R. 13, W. 5 M., Alberta. (Not Mire.)

Shuswap; lake, river, and railway station, Yale district, B.C. (Not Shoushwap lake, nor Spalumcheen river.)

Shuswap; mountains, east of Shuswap lake, Kamloops and Osoyoos districts, B.C.

Shute; passage, southwest of Portland island, southeast coast of Vancouver I., B.C.

Shute; point, on east shore of Stokes bay, Bruce county, Ont.

Sibbald; creek, tributary to Jumpingpound creek, southern Alberta.

Sibell; bay, Ladysmith harbour, Vancouver island, B.C.

Sibert; point, at southeast entrance to Pine Tree harbour, Bruce county, Ont.

Sicannie Chief. See Sikanni Chief.

Sidney; channel, island, and town, S.E. coast of Vancouver I., B.C. (Not Sydney.)

Sidney; township, in Hastings county, Ont.

Siffleur; mountain, south of the junction of Saskatchewan and Siffleur rivers, Rocky mountains, Alberta.

Siffleur; river, tributary to Saskatchewan river, Alta.

Sifton; lake, south of Shabogama lake, Pontiac county, Que.

Sifton; mount, Hermit range, Selkirk mountains, Kootenay district, B.C.

Sifton; mountains, west of lake Laberge, Yukon.

Siggia. See Haven.

Sikanni Chief; river, tributary to Fort Nelson river, Cariboo and Cassiar districts, B.C. (Not Sicannie Chief.)

Silver; creek, flowing northerly into Fraser river, below Hope, Yale district, B.C.

Silver; islet, in L. Superior, 6 miles east of Thunder cape; also Silver Islet landing, wharf and settlement, on north shore of L. Superior, ¾ of a mile from Silver islet, Thunder bay district, Ont.

Silver; lake, lying partly on the east side of Pettypiece township, Kenora district, Ont. (Not Manitou.)

Silver; mountain, Lybster township, Thunder Bay district, Ont.

Silver. See Lowes.

Silverhorn; mountain, north of Bow lake, southern Alberta.

Silver Salmon; river, tributary to Nakina river, Cassiar district, B.C.

Silvertip; glacier, mountain, névé, and pass, northwest of Sir Sandford range, Selkirk mountains, Kootenay district, B.C.

Simcoe; bank and point, entrance to Providence bay, Manitoulin island, Ont.

Simcoe; county and lake, southeast of Georgian bay, Ont.

Simcoe; island, west of Wolfe island, St. Lawrence river, Frontenac county, Ont. (Not Gage.)

Similkameen; river, Similkameen and Yale dists., B.C. (Not South Similkameen.)

Simmons; creek, tributary to Stewart river, below Scroggie creek, Yukon.

Simms. See Sims.

Simon; bay and point, entrance to Greenough harbour, Bruce county, Ont.

Simon; lake, south of Obaska lake, Timiskaming county, Que.

Simonette; river, tributary to Smoky river, Alberta.

Simpson; lake and mountains, between Liard and Frances rivers, Yukon.

Simpson; pass and river, N.W. of Mt. Assiniboine, Alta. and Kootenay district, B.C.

Simpson; rock, Southgate group, Queen Charlotte sound, Coast district, B.C.

Simpson Tower; mountain, west of Frances lake, Yukon. (Not Simpson's.)

Sims; bay and island, South bay, Manitoulin district, Ont. (Not Simms.)

Sincique. See St. Sixte.

Singoosh. See Singush.

Singush; lake, in Duck Mountain Forest reserve, western Manitoba. (Not Singoosh.)

Sinking; lake, Tps. 59 and 60, R. 6, W. 4 M., eastern Alberta.

Sinkut; creek and lake, south of Nechako river, Cariboo, B.C. (Not Tsinkut.)

Sipanok; channel, between Carrot and Saskatchewan rivers, Sask. (Not Seepanok nor Seepanock.)

Sipiwesk; lake, north of Cross lake, Nelson river, Manitoba. (Not Sepewesk.)

Sir Donald; mount, also glacier and range of mountains in the Selkirks, B.C.

Sir Sandford; mount, also range of mountains and glacier, Selkirk mountains, Kootenay district, B.C.

Sir William; island, west of Lyndoch island, St. Lawrence river, Leeds county, Ont.

Sisipuk; lake on Churchill river, Manitoba and Saskatchewan. (Not Duck.)

Sisson; lake and river, tributary to Tobique river, Victoria county, N.B. (Not Little Tobique nor West Branch of Tobique river.)

Sisters; islands, east of Fair point and northwest of Gordon island, St. Lawrence river, Leeds county, Ont.

Sitidgi; lake, north of Great Bear lake, N.W.T. (Not Setidgi.)

Siwiti; rock, Blunden harbour, Queen Charlotte sound, Coast district, B.C.

Six-mile. See Saugum.

Sixteen mile. See Oakville.

Sixty; creek, branch of Henderson creek, Yukon.

Sixtymile; river, tributary to Yukon river, Yukon.

Skagit; range of mountains and river, Yale district, B.C.

Skaloo. See Skelu.

Skeena; river, emptying into the Pacific, Cassiar and Coast dists., B.C. (Not Skena.)

Skelton; island, Brock group, St. Lawrence R., Leeds Co., Ont. (Not Big nor Round.)

Skelu; inlet, Graham island, Queen Charlotte Is., Coast district, B.C. (Not Skaloo.)

Skena. See Skeena.

Skidegate; inlet, also channel between Graham and Moresby islands, Queen Charlotte islands, Coast district, B.C.

Skinner; bluff, north of Cowichan harbour, Vancouver island, B.C.

Skinner Pond; village, Prince county, P.E.I. (Not Skinner's Pond.)

Skirmish. See Wild Horse.

Skirt; mountain, west of Esquimalt, Vancouver island, B.C. (Not Skirt hill.)

Skoki; mountain and valley, northwest of Fossil mountain, Rocky Mts., Alta.

Skookum; lake, Galbraith township, Algoma district, Ont. (Not Shookum.)

Slate; creek, tributary to Klondike river, Yukon.

Slate; lake, on Wenasaga river, northwest of L. Seul, Patricia district, Ont.

Slate; pass, between headwaters of Klondike and McQuesten rivers, Yukon.

Slaughenwhite; point, northeast of Head harbour, St. Margaret bay, Halifax county, N.S. (Not Oakland.)

Slave. See Lesser Slave.

Slave. See Sleeve.

Sleepy; river, emptying into Obaska lake, Timiskaming county, Que.

Sleeve; lake, Tps. 59 & 60, R. 6, W. 4 M., eastern Alberta. (Not Slave.)

Slocan; lake, river, and town, Kootenay district, B.C. (Not Slocan City.)

Slocoh. See Sloko.

Sloko; inlet, lake, mountain, and river, Cassiar district, B.C. (Not Slocoh.)

Small. See Little Bow.

Small Duck; creek, tributary to Rock creek, Klondike river, Yukon.

Small Trout. See Meggisi.

Smart; mount, west of mount Bonney, Selkirk mountains, Kootenay district, B.C.

Smith; creek, tributary to the south branch of Brazeau river, central Alberta.

Smith; point, southwestern point of Cockburn island, Manitoulin district, Ont.

Smith; rock, in Fitzwilliam channel, Manitoulin district, Ont.

Smith. See Wynott.

Smith's. See Riall.

Smith's creek. See Nith river.
Smith's island. See Port Hood island.
Smiths Falls; railway station and town, Lanark county, Ont. (Not Smith's Falls.)
Smoke; lake, in Algonquin National park, Nipissing district, Ont.
Smoke; point, in Weller bay, Ameliasburg township, Prince Edward county, Ont.
Smoke. See Aubrey.
Smoke. See Hickey.
Smokehouse; island, north of Chiefs point, Bruce county, Ont.
Smoky; lake, northwest of Victoria settlement, Alberta.
Smoky; river, tributary to Peace river, Alberta. (Not Smoking.)
Smoothrock; lake, northwest of L. Nipigon, Thunder Bay district, Ont. (Not Smooth Rock Island lake.)
Smoothrock; lake, south of Manitou lake, Kenora district, Ont. (Not Smooth Rock.)
Snake; island, north of Cedar island, bay of Quinte, Hastings county, Ont.
Snake; island, off Departure bay, east coast of Vancouver I., B.C. (Not Lighthouse.)
Snake. See Bloomfield.
Snake. See Fox.
Snake. See McCallum.
Snake. See Matheson.
Snake. See Sylvan.
Snares. See Schnare.
Snider; post office, Halton county, Ont. (Not Snider's Corners.)
Snider; rock, northwest of Martini I., S.W. coast of Digby I., Coast district, B.C.
Snider's Corners. See Snider.
Snowcap; mountain, west of lower part of Stikine river, Cassiar district, B.C.
Snowdon; range of mountains, southeast of Gladys lake, Cassiar district, B.C.
Snowslide; creek, tributary to Cariboo creek, Kootenay district, B.C.
Snowy; mountain, east of Stikine river, near the elbow, Cassiar district, B.C.
Sockeye; railway station, north shore of Skeena river, Coast district, B.C.
Soda; creek, flowing into upper branch of Hunker creek, Yukon.
Sodalite; valley, east of Ice river, Rocky mountains, Kootenay district, B.C.
Sogakwa; portage, at head of Pizustigwan river, upper Winisk river, Patricia, Ont.
Solitude; mountain, east of Columbia river, Rocky mountains, Kootenay district, B.C.
Solmes; island, east of Telegraph island, bay of Quinte, Prince Edward county, Ont.
Solmesville; post village, Sophiasburg township, Prince Edward county, Ont.
Solomons Temples; islands, north of Charlton island, James bay, New Quebec. (Not Solomon Temple.)
Somass; river, flowing into the head of Alberni canal, Vancouver island, B.C. (Not Somas, Somos, Sumas, nor Sumass.)
Somenos; lake and post settlement, north of Cowichan river, Vancouver island, B.C.
Somerset; island, north of Boothia peninsula, N.W.T. (Not North Somerset.)
Sonata; mountain and névé, Selkirk mountains, Kootenay district, B.C.
Sonora; island, between Nodales and Okisollo channels, Coast district, B.C. The northern portion of what was formerly Valdes island.
Sooke; basin, bay, harbour, inlet, lake, and river, Vancouver island, B.C.
Sophia; mountain, Kootenay and Similkameen districts, B.C.

Sophiasburg; township, Prince Edward county, Ont. (Not Sophiasburgh.)

Sorcerer; glacier and mountain, Selkirk mountains, Kootenay district, B.C.

Soskumika; lake, an expansion of Nottaway river, Abitibi territory, Que.

Soulanges. See Dondaine.

Sounding; creek and lake, southeastern Alberta.

Source; lake, in Algonquin National park, Nipissing district, Ont.

Souriban. See Sholiaban.

Sourilban. See Sholiaban.

Souris; river, tributary to the Assiniboine, Manitoba and Saskatchewan.

Souris; town, Kings county, P.E.I. (Not East Souris.)

South; bay, S.E. end of Manitoulin I., Manitoulin dist., Ont. (Not Manitoulin Gulf.)

South; lake, on international boundary, Thunder Bay district, Ont.

South. See Algernon.

South. See Koksoak.

South. See Prince Edward.

Southampton; village, at the mouth of Saugeen river, Bruce county, Ont.

South Antler. See Antler.

South Bay. See Prince Edward.

South Baymouth; town site, Manitoulin island, Manitoulin district, Ont.

South Branch of Highwood river. See Stimson creek.

South Branch of Little river. See Flemming brook.

South Branch of Moose river. See Mattagami river.

South Branch or Fork of Michel creek. See Leach creek.

South Fork of Gold creek. See Caven creek.

South Fork of Grave creek. See Harmer creek.

South Duck; river, flowing easterly and northerly to Duck bay, lake Winnipegosis, Man. (Not Duck River South.)

Southern Indian; lake, on Churchill R., Manitoba. (Not Indian nor South Indian.)

Southesk; river, tributary to Brazeau river, Alberta. (Not Southesk Branch.)

South fork of Beaver (creek). See Crystal.

South Fowl; lake, on Int. boundary, Thunder Bay district, Ont. (Not Cock.)

Southgate; river, flowing southwesterly into Bute inlet, Coast district, B.C.

South Heart; river, flowing into the northwest end of Lesser Slave lake, Alberta.

South Joggins. See Joggins.

South Joggings. See Joggins.

South Mya. See Mya.

South Nation; river, flowing through the counties of Grenville, Dundas, Stormont, Russell, and Prescott, and emptying into the Ottawa. (Not Little Nation, Nation, nor Petite Nation.)

South Petawawa. See Petawawa.

South Porpoise. See Lelu.

South Rideau river. See Kemptville creek.

South Similkameen. See Similkameen.

South Thompson; river, flowing from the Shuswap lakes to Kamloops lake, Kamloops district, B.C.

South Thompson; river, flowing from the Shuswap lakes to Kamloops lake, Yale district, B.C.

South Wellington; post settlement, west of Nanaimo river, Vancouver island, B.C.

Southwest; bay, in lake Evans, Abitibi territory, Que.

Southwest; point, Anticosti island, Saguenay county, Que. (Not South West.)

Soyers; lake, Minden township, Haliburton county, Ont.

Spallumcheen. See Shuswap.

Spar; lake, south of Separation lake, Kenora district, Ont.

Spardan. See Ferguson.

Sparrow; island, southwest of Stovin I., Brock group, St. Lawrence R., Leeds Co., Ont.

Spearing; mount, north of Tulameen river, Yale district, B.C.

Spectacles; rocks, 1½ miles west of Gananoque, St. Lawrence river, Leeds county, Ont.

Spectacles; islands (2) north of Wolfe I., St. Lawrence R., Frontenac Co., Ont.)

Spence; lake, south of lake Winnipegosis, Manitoba.

Spencer; creek, tributary to Bow river, Alberta.

Spicer; harbour and island, north shore of Hudson strait, N.W.T.

Spike; peak, northeast of Moberly, Rocky mountains, Kootenay district, B.C.

Spillimacheen; mountains, also river tributary to Columbia river, Kootenay district, B.C. (Not Spill En Mee Chene nor Spillimichene.)

Spilsbury; island, Navy group, St. Lawrence river, Leeds county, Ont.

Spire; island and ledge, S. of Frederick Pt., Prince Rupert harbour, Coast dist., B.C.

Spirit; creek, tributary to Wild Horse river, Kootenay district, B.C.

Spirit; river, also Spirit River, post settlement, central Alberta.

Spirit. See Beauchamp.

Spit; head, westerly extreme of Howe island, St. Lawrence river, Frontenac Co., Ont.

Split; cape, Kings county, N.S. (Not Splitt.)

Split; lake, on Nelson river, Manitoba.

Spong; island, northeast of Whitney point, St. Lawrence river, Leeds county, Ont.

Spray; mountains and river, south of Bow river, Rocky Mountains park, Alberta.

Spring; cove, southwest side of entrance to Gehuelet arm, Barkley sound, Vancouver island, B.C.

Springer; point, on the south side of Sonora island, Coast district, B.C.

Springhill; post settlement, west of Fredericton, York county, Ont.

Springhill; village, Frontenac county, Que. (Not Spring Hill.)

Sproat; mount, north of Upper Arrow lake, Kootenay district, B.C.

Spruce; river, flowing southerly into the Saskatchewan at Prince Albert, Sask. (Not Little Red.)

Sprucegrove; post office, west of Edmonton, Alberta. (Not Spruce Grove.)

Squally; reach, in southern portion of Saanich inlet, Vancouver island, B.C.

Squamish; pass and post office, also river entering the head of Howe sound, B.C.

Square; bay, east of Dominion point, Manitoulin island, Manitoulin district, Ont.

Square; brook, flowing into Minas channel, Kings Co., N.S. (Not Square Cove brook.)

Square; lake, northeast of L. LaBiche, central Alberta.

Square. See Squire.

Squaw. See Brock.

Squire; point, on Call creek, between Johnstone strait and Knight inlet, Coast district, B.C. (Not Square.)

Squirrel. See Footprint.

Srigley; bay, south shore of Manitoulin island, Manitoulin district, Ont.

Stafford; rock, north of Western Duck island, Manitoulin district, Ont.

Stainforth. See Staniforth.

Stake; creek, flowing into Quiet lake, Yukon.

Stanawan; lake, S.W. of Dinorwic L., Kenora district, Ont. (Not Grassy River lake.)

Stanford; range of mountains, between Columbia and Kootenay rivers, B.C.

Staniforth; point, entrance to Gardner canal, Coast district, B.C. (Not Stainforth.)

Stanley; a spur of the Valkyr mountains, Kootenay district, B.C.

Stanley; island, near Summerstown, Glengarry county, Ont. (Not Craigs.)

Stanley; river, tributary to Tatshenshini river, Cassiar district, B.C.

Stanley; village, York county, N.B. (Not Stanley Village.)

Stanley Corners; post office, Carleton county, Ont. (Not Stanley's Corners.)

Stanley Mills; post office, Peel county, Ont. (Not Stanley's Mills.)

Stanley Village. See Stanley.

Stanzhikimi; lake, west of Tawatinaw lake, Kenora district, B.C.

Stapledon; island, E. of Lelu I., near entrance Inverness passage, Coast district, B.C.

Star; creek, branch of Hunker creek, Yukon.

Starnesboro; post office, Huntingdon county, Que. (Not Starnesborough.)

Starr; creek, tributary to Pelly river, between Hoole and Ketza rivers, Yukon.

Starvation; creek, on the international boundary, Kootenay, B.C. (Not Akamina.)

Starvation. See Strawberry.

Stave; island, Navy group, St. Lawrence river, Leeds county, Ont. (Not Big Stave.)

Steamboat. See Shawatum.

Steel. See Hayes.

Steele; town, Kootenay district, B.C. Railway station of same name 7 miles south of town. (Not Fort Steele.)

Steep; creek, tributary to Beaverfoot river, Rocky mountains, Kootenay district, B.C.

Steepbank; river, emptying into lake Claire, Alta. (Not Steep Bank nor Steep-bank.)

Steeprock; lake, west of Crane bay, also point east of Peonan point, L. Manitoba. (Not Steep Rock.)

Steeprock; river, flowing to northerly end of L. Winnipegosis, Man. (Not Steep Rock.)

Steevens; island, north of Greene island, Manitoulin district, Ont. (Not Cariboo nor Little Green.)

Stelako. See Stellako.

Stella; village, on telegraph trail near mouth of Stellako river, Coast district, B.C.

Stellako; river, connecting Francois and Fraser lakes, B.C. (Not Stelako.)

Stephen; lake, north of Kakagi lake, Kenora district, Ont.

Stephen; mount, and railway station, Kootenay district, B.C.

Stephens. See Navy.

Sterling. See Stirling.

Stevens; creek, north of Whatshan lake, Kootenay district, B.C.

Stevens; island, Southgate group, Queen Charlotte sound, Coast district, B.C.

Stevens; mount, south of Wheaton river, southern Yukon.

Stevens. See Navy.

Stewart; canyon, Cascade river, Rocky Mountains park, Alberta.

Stewart; lake, west of Parrywood station, Kenora district, Ont.

Stewart; river, tributary to Yukon river, Yukon.

Stewart; rock, in Owen channel, Manitoulin district, Ont.

Stewart. See Rouyn.

Stewart. See Stuart.

Stick-ah-din. See Stikyardin.

Stickelahn. See Stikela.

Stikela; creek, flowing into Tatlayoko lake, Coast district, B.C. (Not Stickelahn.)

Stikine; river, Cassiar district, B.C. (Not Stickeen nor Stikeen, etc.)

Stikyadin; lake and mountains, at junction of Bulkley and Skeena rivers, Cassiar district, B.C. (Not Stick-ah-din.)

Stimson; creek, tributary to Highwood river, Alta. (Not S. Branch of Highwood R.)

Stimukoktok; cape, east shore Ungava bay, New Quebec.

Stirling; lake and village, southwestern Alta. (Not Sterling nor Eighteen Mile lake.)

Stittville; post village and railway station, Carleton county, Ont. (Not Stittsville.)

Stockham; island, east of Opitsat, Clayoquot sound, Vancouver island, B.C.

Stockmer; mount, north of Howard creek, Selkirk Mts., Kootenay district, B.C.

Stockwell; lake, Tp. 27, R. 8,, and Tps. 27 and 28, R. 9, W. 3 M., Saskatchewan. (Not Red Deer.)

Stokes; bay and river, in Bruce county, Ont.

Stone; island, southeast of Stockham island, Clayoquot sound, Vancouver I., B.C.

Stone. See Mirond.

Stoneberg; cove, Weller bay, Prince Edward county, Ont.

Stoneburgh; cove, Weller B., Ameliasburg Tp., Pr. Edw. Co., Ont. (Not Stoneburgh's.)

Stonecliff; railway station and village, Renfrew county, Ont. (Not Rockliffe.)

Previous decision revised, P.O. Dept. and Ry. Co. having changed the name to avoid confusion with the well known 'Rockcliffe' at Ottawa.

Stonehouse. See Glengarry.

Stoney; creek and Stoney Creek village, Wentworth county, Ont. (Not Stony.)

Stony; creek, tributary to M'Clintock river, Yukon.

Stony; islet, north of Kincardine, Bruce county, Ont.

Stony, lake, Burleigh township, Peterborough county, Ont.

Stony; point, north of Corbay point, Manitoulin district, Ont.

Stony; point, Presque'ile bay, Brighton Tp., Northumberland Co., Ont. (Not Stoney.)

Stony. See Barrie.

Stony. See Blake.

Stony. See Melfort.

Stony. See Okemasis.

Stony. See Stoney.

Stonyplain; post office, west of Edmonton, Alberta. (Not Stony Plain.)

Stoplog; lake, Burleigh township, Peterborough county, Ont. (Not Stop Log.)

Storm; creek, tributary to Highwood river, Alberta.

Storm; mountain, north of mount Ball, Alta. and Kootenay district, B.C.

Stormy; lake, Glamorgan township, Haliburton county, Ont.

Stouffville; village and railway station, Whitchurch township, York county, Ont. (Not Stouffville Junction.)

Stovel; peak, south of Talaha bay, Tagish lake, Cassiar district, B.C.

Stovin; island, Brock group, St. Lawrence R., Leeds, Ont. (Not Picnic nor Refugee.)

Straggle; lake, Harcourt township, Haliburton county, Ont.

Straight. See Opinaka.

Stranger; lake, southwest of Kimmewin lake, Kenora district, Ont.

Stratford; township, Wolfe county, Que.

Stratharbo; settlement, Northumberland county, N.B. (Not Strathabo.)

Strathcona; island, west of Crooks inlet, north shore of Hudson strait, N.W.T.

Strawberry; island, in lake Simcoe, Ontario county, Ont. (Not Starvation.)

Stuart; channel, southeast coast of Vancouver island, B.C.

Stuart; lake and river, tributary to Nechako river, Coast district, B.C. (Not Stewart.)

Stupart; bay, south shore of Hudson strait, New Quebec.

Sturgeon. See Chalk.

Sturgeon. See Crémazie.

Sturgeon. See Namew.

Sturgeon. See Nemei.

Sturgeon-weir; river, flowing into Cumberland lake, Sask. (Not Sturgeon Weir.)

Stutfield; peak, southeast of mount Alberta, Rocky mountains, Alberta.

Stutzer; mount, east of Nordenskiöld river, Yukon.

Sucker. See Garden.

Sucker. See Gladys.

Sucker. See Nemeibennuk.

Sugar. See Mulcaster.

Sugarbush; lake, Addington township, Ottawa county, Que. (Not Sugar Bush.)

Sugarloaf; mountain, northwest of Beaver mountain, Selkirk mountains, Kootenay district, B.C.

Sugarloaf; mountain, near Stikine river, north of Iskut river, Cassiar district, B.C.

Suggi; lake, on Grassberry river, central Saskatchewan. (Not Little Pelican.)

Sullivan; hill, north of St. Mary river, Kootenay district, B.C.

Sullivan; lake, south of Battle river, Alberta. (Not Sullivan's.)

Sullivan; mount, east of mount Lyell, Rocky mountains, Alberta.

Sullivan; mount, west of Dease lake, Cassiar district, B.C.

Sulphur; creek, tributary to Indian river, Yukon.

Sulphur; mountain, south of Banff, Alberta.

Sumac. See Robert.

Sumach. See Everest.

Sumallo; river, tributary to Skagit river, Yale district, B.C. (Not Sumallow.)

Sumas; lake, post office, railway junction, and river, south of Fraser river, New Westminster district, B.C. (Not Sumass.)

Sumass. See Somass.

Sumass. See Sumas.

Summit; lake, south of Bernard lake, Cassiar district, B.C.

Summit; railway station, Kenora district, Ont.

Summit. See Sasakwei.

Sunday; lake, Rowell township, Kenora district, Ont.

Sunday; mountain, west of the north end of lake Laberge, Yukon.

Sunday; peak, east of Tagish lake, Cassiar district, B.C.

Sunny Brae; post office and railway station, Westmorland county, N.B.

Sunshine; creek, east of Lower Arrow lake, Kootenay district, B.C.

Sunshine; lake, northeast of Manitou lake, Kenora district, Ont.

Sunwapta; river, flowing from Wilcox pass northwesterly into Athabaska river, Alberta.

Superior, Lake; (Fr. Lac Supérieur). The largest body of fresh water in the world and highest of the five great lakes of the St. Lawrence system.

Supply. See Depot.

Surge; narrows, easterly entrance to Okisollo channel, Coast district, B.C.

Surprise; lake, an expansion of the upper Broadback river, Abitibi territory, Que.

Surprise; lake, east of Atlin lake, Cassiar district, B.C. (Not Kusiwah.)

Surprise; lake, south of Onamakawash lake, Thunder Bay district, Ont.

Surprise; mountain, west of the north end of lake Laberge, Yukon.

Survey; mountain, at headwaters of Leech river, Vancouver island, B.C.

Surveyor; island, opp. Bucks bay, St. Lawrence R., Leeds Co., Ont. (Not Surveyor's.)

Suskwa; river, tributary to Bulkley river, near Hazelton, Cassiar district, B.C. (Not Bear nor Susqua.)

Sutherland; river, tributary to Inverness river, south of Lesser Slave lake, Alta.

Sutil; cape, at westerly entrance to Goletas channel, northerly coast of Vancouver island, B.C. (Not Commerell.)

Sutton; bay, at north end of lake Timiskaming, Ont. (Not Sutton's.)

Sutton; lake, north of Ekwan river, Patricia, Ont. (Not Sutton Mill lake.)

Sutton Junction; post office and railway station, Brome county, Que. (Not Drummondville Junction.)

Swamp; lake and portage, southwest of Saganaga lake, international boundary, Rainy River district, Ont.

Swan; island, in Columbia river, between Upper and Lower Arrow lakes, B.C.

Swan; lake and river, also Swan River, post office and railway station, Manitoba.

Swan; river, flowing northerly into Lesser Slave lake, central Alberta.

Swan. See Garson.

Swanson; channel, between Moresby and Pender Is., S.E. coast of Vancouver I., B.C.

Swanzy; mount, also glacier, east of Mt. Bonney, Selkirk Mts., Kootenay district, B.C.

Sweathouse; creek, tributary to Little Smoky river, Alta. (Not Sweat House.)

Swede; creek, tributary to Yukon river, above Dawson, Yukon.

Swede; island, southeast of Sturgeon bay, Thunder Bay district, Ont.

Sweet Herb. See Wekusko.

Swehl-tcha. See Cultus.

Swetman; island, the eastern of the "False Ducks"—which see.

Swiss; peaks, Selkirk mountains, Kootenay district, B.C.

Sydney. See Sidney.

Sylvan; lake, east of Medicine river, southern Alberta. (Not Snake.)

Sylvia Grinnell; river, emptying into Frobisher bay, N.W.T.

Syndicate; lake, west of Manitou lake, Kenora district, Ont.

Syringa; creek, tributary to Columbia R., S. of Lower Arrow L., Kootenay dist., B.C.

T

Tabasintac. See Tabusintac.

Tabasokwia; river, tributary to upper Winisk river, Patricia district, Ont.

Tabernacle; mountain, Selkirk range, Kootenay district, B.C.

Tabisintac. See Tabusintac.

Table; mountain, Tp. 4, R. 2, W. 5 M., southern Alberta.

Tabusintac; river and village, Northumberland county, N.B. (Not Tabasintac nor Tabisintac.)

Tache; railway station, Kenora district, Ont.

Tachick; lake, on telegraph trail, south of Nechako river, Coast district, B.C.

Tacho. See Tatsho.

Tackle; creek, tributary to Wild Horse river, Kootenay district, B.C.

Tadoussac; township and village, Saguenay county, Que. (Not Tadousac.)

Taggart; creek and lake, tributary to Cowan river, central Sask. (Not Rat.)

Tagish; lake and post office, east of Bennett lake, Cassiar district, B.C., and Yukon.

Tahltan; lake, and river tributary to Stikine river, Cassiar district, B.C.

Tahltaloo. See Campbell.

Tahte. See Nisling.

Taibi; lake, south of Mattagami lake, Abitibi territory, Que.

Takakkaw; falls, Yoho river, Rocky mountains, Kootenay district, B.C.

Takameshau. See Eau Dorée.

Takhini; river, tributary to Lewes river, Yukon.

Takipy. See Kississing.

Taku; arm of Tagish lake, Cassiar district, B.C. and Yukon.

Taku; river, Cassiar district, B.C.

Taku. See Graham.

Talaha; bay, in Taku arm of Tagish lake, Cassiar district, B.C.

Talbot; lake, Redditt township, Kenora district, Ont.

Tallan; lake, Chandos township, Peterborough county, Ont. (Not Tallan's.)

Tallon; creek, tributary to Beaverfoot R., S.E. of Leanchoil, Kootenay district, B.C.

Taltmain; lake, south of lower Pelly river, Yukon.

Tamagaming. See Timagami.

Tamihi; creek, New Westminster and Yale districts, B.C. (Not Tamihy nor Tammeahai.)

Tangamong; lake, Lake township, Hastings county, Ont. (Not Tangamongue.)

Tangier; harbour, island ,lake, and town, Halifax Co., N.S. (Not Tangier Grand lake.)

Tantalus; butte, near confluence of Lewes and Nordenskiöld rivers, Yukon.

Tanzilla; river, tributary to Stikine river, Cassiar district, B.C.

Taouagadec. See Tawagadik.

Tapani; lake and river, tributary to Lièvre river, Montcalm county, Que. (Not Tapanee nor Tepanee.)

Tar; island, east of Rockport, St. Lawrence river, Leeds county, Ont.

Tarte; bay, in Kitimat arm, Coast district, B.C.

Taseco. See Taseko.

Taseko; lakes (2) and river, tributary to Chilko river, Lillooet district, B.C. (Not Taseco nor Whitewater.)

Tasheigama. See Asheigamo.

Tashka; rapids, upper Winisk river, above Tabasokwia R., Patricia district, Ont.

Tasin; mountains, upper Stewart river, Yukon.

Tasso; lake, Finlayson township, Nipissing district, Ont.

Tasurak. See Payne.

Tatchun; river, tributary to Lewes river, between Rink and Five-finger rapids, Yukon. (Not Tatchum.)

Tatei; ridge, east of Mumm peak, Rocky mountains, Cariboo district, B.C. (Not Tatay.)

Tatiki. See Tattiki.

Tatla; lake, headwaters of Chilanko river, Coast district, B.C.

Tatlahco. See Tatlayako.

Tatlayako; river, tributary to Bella Coola river ,Coast district, B.C. (Not Tatlahco nor Tatlayoo.)

Tatlayoco. See Tatlayoko.

Tatlayoko; lake, west of Chilko lake, Coast district, B.C. (Not Tatlayoco.)

Tatlayoo. See Tatlayako.

Tatlow; mount, east of Chilko lake, Lillooet district, B.C.

Tatonduk; river, tributary to Yukon river, Yukon. (Not Tatonduc.)

Tatshenshini; river, tributary to Alsek river, Cassiar district, B.C. and Yukon.

Tatsho; creek, tributary to Tanzilla river, Cassiar district, B.C.

Tatsho; mountain, Cassiar district, B.C. (Not Tacho, nor Eightmile.)

Tattiki; bay, in Taku arm of Tagish lake, Cassiar district, B.C. (Not Tatiki.)

Tawagadik; river, flowing into Matane river, Matane county, Que. (Not Taonagadec nor Towagodi.)

Tawatinaw; lake and river, in eastern portion of Kenora district, Ont.

Tawatinaw; river, flowing into Athabaska river, near Athabaska town, Alberta.

Tawina; creek, tributary to Silver Salmon river, Cassiar district, B.C.

Taxes; river, trib. to Miramichi R., York Co., N.B. (Not Taxis, Taxous nor Texas.)

Taxis. See Taxes.

Taxous. See Taxes.

Tay; river, tributary to Pelly river, Yukon.

Taye; lake, southeast of Hutshi lakes, Yukon.

Taylor; island, south of Port Dover, Halifax county, N.S. (Not Dover nor Taylor's.)

Taylor; reef, Misery bay, Manitoulin island, Manitoulin district, Ont.

Taysen; lake, northwest of Ruth lake, Cassiar district, B.C.

Tchork-back. See Chorkbak.

Tea; lake, in Algonquin National park, Nipissing district, Ont.

Teal; lake, on Grass river, Manitoba.

Tecumseh; cove, Cove island, at entrance to Georgian bay, Bruce county, Ont.

Teggau; lake, southeast of Winnange lake, Kenora district, Ont. (Not Clearwater.)

Tekarra, mount, east of Athabaska R., opposite the mouth of Miette R., Alta.

Telegraph; creek, tributary to Stikine river, Cassiar district, B.C.

Telegraph Creek; village, Cassiar district, B.C.

Telegraph; island and narrows, bay of Quinte, Hastings and Prince Edward Cos., Ont.

Telkwa; river, tributary to Bulkley R. Coast district, B.C. (Not Tel-kwa nor Telqua.)

Temagami. See Timagami.

Temiscaming. See Timiskaming.

Temiscamingue. See Timiskaming.

Temiskaming. See Timiskaming.

Tempest; lake, south of Surprise lake, Thunder Bay district, Ont.

Temple; mount, east of mount Lefroy, Alberta.

Tenants. See Terence.

Tendinenda; lake, Mack and Scarfe townships, Algoma district, Ont. (Not Madendanada, Matinatinda, nor Tendinendan.)

Tenecape. See Tennycape.

Tenny; cape, Hants county, N.S. (Not Teny.)

Tennycape; river and village, Hants county, N.S. (Not Tenecape nor Tenycape.)

Ten Peaks; valley of, east of mount Temple, Alta. (Not Desolation nor Lonely.)

Tent; mountain, south of Crowsnest, Alta., and Kootenay district, B.C.

Tent. See Peel.

Tent Island (shoal). See Peel.

Teny. See Tenny.

Tenycape. See Tennycape.

Terence; basin, bay, river, and rock, also Terence Bay post settlement; Halifax county, N.S. (Not Tenants bay, Tern bay, Turner bay, nor Turnerbay rock.)

Teresa; island, in Atlin lake, Cassiar district, B.C. (Not Goat.)

Terminal; peak, Selkirk mountains, Kootenay district, B.C. (Not Green's peak.)

Terrace; ridge, on Porcupine river, northeast of mount Dewdney, Yukon.

Terrahina; creek, tributary to Nakina R., Cassiar district, B.C. (Not Terra Heena.)

Terry; point, at southeast entrance to Johnston harbour, Bruce county, Ont.

Tesaycau. See Tesekau.

Tesekau; lake, an expansion of the lower part of Marten river, Mistassini territory, Que. (Not Tesaycau.)

Teslin; lake and river, B.C. and Yukon. (Not Hootalinqua nor Teslin-too.)

Tesse-Clewee. See Klewi.

Tetagouche; river, Gloucester county, N.B. (Not Tetcaguche nor Tete à Gouche.)

Teteagouche. See Tetagouche.

Tétreauville; post office, Laval county, Que. (Not Tétreaultville.)

Texas. See Taxes.

The Beehive; mountain, west of lake Louise, Alberta.

The Big (slough). See Alexander.

The Bishops; range of mountains, in the Selkirks, Kootenay district, B.C.

The Coteau; the eastern edge of a prairie steppe, southern Saskatchewan.

The Dome; mountain, northeast of Mt. Bonney, Selkirk Mts., Kootenay district, B.C.

The Elbow. See Elbow.

The Goat's Looking Glass. See Agnes.

The Golden Ears. See Blanshard.

The Grove; post village, east of London, Middlesex county, Ont.

The Knob; mountain, near Stikine R., N. of Iskut R., Cassiar, B.C. (Not "Knob.")

The Lake. See Cobb.

Thelew. See Thelon.

Thelon; river, tributary to Dubawnt river, N.W.T. (Not Ark-e-leenik nor Thelew.)

The Mitre; mountain, east of mount Lefroy, Alberta.

The Monarch; mountain, S.W. of Mt. Bourgeau, Rocky Mts., Kootenay district, B.C.

The Narrows; in South bay, Manitoulin island, Manitoulin district, Ont.

The Needles; narrows, Lower Arrow lake, Kootenay district, B.C.

The Overlook; mountain, in the Selkirks, Kootenay district, B.C.

The Pas. See Pas.

The President; mountain, north of Emerald mountain, Rocky mountains, Kootenay district, B.C. Named for the president of the C.P.R. Co. *See also* President.

The Punts; islands, Lake Fleet group, St. Lawrence river, Leeds county, Ont.

The Rampart; ridge, between Mt. Afton and "The Dome," Selkirk Mts., B.C.

The Ridge; bar, in Owen channel, Manitoulin district, Ont.

Thérien; lakes, in eastern Alberta.

The Saddle. See Saddle mountain.

The Steeples; mountains, east of Kootenay river, Kootenay district, B.C.

The Stragglers. See Wenkchemna.

Thetford; railway station, river, township, and village, Megantic county, Que. (Not Thetford Mines, station and village.)

The Three Guardsmen; mountains, south of Aishihik lake, Yukon.

Thetis; island, north of Kuper island, southeast coast of Vancouver I., B.C.

The Twins. See Twin peaks.

The Vice President; mountain, President range, Rocky mountains, Kootenay district, B.C. (Not Angle peak.) So named for the vice-president of the C.P.R. Co.

The Wart; hill, at mouth of Koksoak river, New Quebec.

Thibault; shoal, running south from Manitoulin island to Inner Duck island, Manitoulin district, Ont.

Thibert; creek, flowing into the northerly end of Dease lake, Cassiar district, B.C.

Thickwood; hills, central Saskatchewan.

Thirty-one-mile; lake, Ottawa county, Que. (Not Grand Lac du Commissaires.)

Thistle; creek, tributary to Yukon river, above White river, Yukon.

Thistle; reef, in Portage bay, Manitoulin island, Manitoulin district, Ont.

Thleweechodezeth. See Backs.

Thom; mount, north of Dartmouth, Halifax county, N.S. (Not Tom.)

Thomas; bay and point, near South Baymouth, Manitoulin district, Ont.

Thomas; river, emptying into the northerly end of Frances L., Yukon. (Not Tootlas.)

Thomasine. See Tomasine.

Thompson; cove, east of cape Spencer, St. John county, N.B.

Thompson; creek, tributary to Watson river, southern Yukon.

Thompson; mount, northwest of Bow lake, Alberta. (Not Thompson's.)

Thomson; lake, Lake township, Hastings county, Ont. (Not Thomson's.)

Thor; mount, west of Upper Arrow lake, Kootenay district, B.C.

Thorn. See Maple.

Threefork; river, flowing into Wabigoon lake, Kenora district, Ont. (Not Three Fork.)

Threehills; creek, north of Kneehills creek, Alberta. (Not Three Hills.)

Threemile Plains; post village, Hants county, N.S. (Not Three Mile Plains.)

Threemount; bay and point, east of McIntyre bay, lake Nipigon, Thunder Bay district, Ont. (Not Three Mount nor Three Mountain.)

Threepoint; creek, tributary to Sheep river, also mountain, southern Alberta.

Threepoint; lake, on Burntwood river, Manitoba. (Not Nistowasis.)

Three Sisters; mountain peaks, south of Canmore, Rocky Mountains park, Alberta.

Thron-diuck. See Klondike.

Thrumcap; shoal, at entrance to Halifax harbour, Halifax county, N.S.

Thumb. See Galena.

Thunder; bay, and cape at east entrance to the bay, Thunder Bay district, Ont.

Thunder; creek, flowing into Pelican lake, southern Saskatchewan.

Thunder; lake, north of Wabigoon lake, Kenora district, Ont.

Thurlow; township, Hastings county, Ont.

Thwartway; island, Admiralty group, St. Lawrence river, Leeds county, Ont. (Not Leak or Leek.)

Tiahn. See Tian.

Tian; point, Graham island, Queen Charlotte Is., Coast district, B.C. (Not Tiahn.)

Ticouabi. See Tikuape.

Tidds; island, Admiralty group, St. Lawrence river, Leeds county, Ont.

Tide; lake, English river, below Maynard lake, Kenora district, Ont.

Tide; rock, Southgate group, Queen Charlotte sound, Coast district, B.C.

Tiernan. See Ogoki.

Tiger; brook, tributary to rivière des Quinze, Timiskaming county, Que.

Tigonankweine; range of mountains, Gravel R. N.W.T. (Not Tigenankwene.)

Tikonabi. See Tikuape.

Tikuape; post office and river, Lake St. John county, Que. (Not Ticouabi, Tikonabe, Tikouabi, Tikouape, nor Tikouapee.)

Til-e-i-tsho. See Tillei.

Tillei; lake, north of Frances lake, Yukon. (Not Til-e-i-tsho.)

Tilley; mount, east of Mt. Mackenzie, Kootenay district, B.C.

Tillsonburg; town, Oxford county, Ont. (Not Tilsonburg.)

Tilted; mountain, west of Lychnis mountain, Rocky mountains, Alberta.

Timagami; lake, Nipissing district, Ont. (Not Tamagaming nor Temagami.)

Timber; bay, and Timber Bay shoal, S. shore of Manitoulin I., Manitoulin dist., Ont.

Timber; island, the western of the "False Ducks"—which see.

Timiskaming; lake, Timiskaming, Ontario and Quebec. (Not Temiscaming, Temiscamingue, nor Temiskaming.)

Tinson; point, Gabriola island, strait of Georgia, B.C. (Not Rocky.)

Tintina; valley, central Yukon. A great depression occupied successively by Pelly, Kalzas, Stewart, and Klondike rivers, and extending to the Yukon.

Tisiriuk; lake, emptying into Leaf river, New Quebec. (Not Seal.)

Titkana; peak, northeast of Mount Robson, Rocky mountains, Cariboo district, B.C. (Not Ptarmigan.)

Tlet-tlan-a-tsoots. See Finlayson.

Tobermory; harbour and village, at N.W. extreme of Saugeen peninsula, Bruce Co., O.

Tobey; point, west side of Prince Rupert harbour, Coast district, B.C.

Tobique; river, tributary to St. John river, from Nictor lake, Restigouche and Victoria counties, N.B. The names 'Nictor' and 'Little Tobique,' applied to that portion of the river above 'the forks,' to be dropped.

Tobique. See Trousers.

Toby; creek, flowing easterly into Columbia river, at Athalmer, Kootenay district, B.C. (Not Toba.)

Tod; creek and inlet, Saanich inlet, Vancouver island, B.C.

Todman; reef, at mouth of Thomas bay, Manitoulin island, Manitoulin district, Ont.

Todnustook. See Tulnustuk.

Tofino; inlet, also townsite on Low peninsula, Clayoquot sound, Vancouver I., B.C.

Tokumm; creek, south of Deltaform mountain, Kootenay district, B.C.

Tolmie; reef, between Kincardine, and Clark point, Bruce county, Ont.

Tom. See Thom.

Tomasine; river, Pontiac county, Que. (Not Thomasine nor Tomassino.)

Tombstone; mountain, northeast of Kananaskis lakes, southern Alberta.

Tomkinson; point, Ursula channel, Coast district B.C. (Not Tomkinsin.)

Tomlinson. point, Blunden harbour, Queen Charlotte sound, Coast district, B.C.

Tonkawatla; river, tributary to Columbia R., Kootenay dist., B.C. (Not Tonca Watla.)

Toochi. See Tutshi.

Too-flat; creek, tributary to Klondike river, Yukon.

Toohoolitas. See Tuhulitas.

Toolnustook. See Tulnustuk.

Too-much-gold; creek, tributary to Klondike river, Yukon.

Toonkwa. See Tunkwa.

Too-tlas. See Thomas.

Tooya. See Tuya.

Topham; mount, southeast of Mt. Macoun, Selkirk mountains, Kootenay district, B.C.

Torch; lake, southwest of Candle lake, central Saskatchewan. (Not Little Candle.)

Torch; river, emptying into Cumberland lake, eastern Sask. (Not Big Sturgeon.)

Tornait. See Newton.

Torrent. See St. Mary.

Torres; channel, between Teresa and Copper islands and west shore of Atlin lake, Cassiar district, B.C. (Not West channel, Torres straits, nor Tory inlet.)

Tortue; river, Saguenay county, Que. (Not Fall.)

Tortue. See Orme.

Tory. See Torres.

Totogan; lake, north of Kanuchuan river, upper Winisk river, Patricia district, Ont.

Touchwood; hill, southern Saskatchewan.

Toussaint; island, above Iroquois point, St. Lawrence river, Dundas county, Ont. (Not Tousaint's, Toussaint's, nor Toussons.)

Toussons. See Toussaint.

Towagodi. See Tawagadik.

Tower; creek, tributary to St. Mary river, Kootenay district, B.C.

Tower; peak, north of Quiet lake, Yukon.

Tower of Babel; mountain, east of Moraine lake, southern Alberta

Towincut; creek and mountain, S. of Cowichan L., Vancouver I., B.C. (Not Nixon.)

Toyehill; village, Dundas county, Ont. (Not Toy's Hill.)

Tracy; creek and post office, east of Kootenay river, north of Steele, Kootenay, B.C.

Trade; lake, on Churchill river, above Reindeer river, Sask. (Not Island lake.)

Trading; lake, Ridout township, Muskoka district, Ont.

Traffic; mountain, north of Pelly lakes, Yukon.

Trail. See Chungo.

Tramping; lake, southwest of Battleford, Sask.

Trap; mountain, west of Sooke river, Vancouver island, B.C.

Trapper; creek, tributary to W. fork of Kettle river, Similkameen district, B.C. (Not E. fork of W. fork of Kettle river.)

Travers (lac de): lake, at headwaters of St. Maurice river, Champlain county, Que.

Traverse; bay, mouth of Winnipeg river, Manitoba.

Tremayne; bay, in southern portion of Digby island, Coast district, B.C.

Trent; river, flowing into the bay of Quinte at Trenton, Hastings and Northumberland counties, Ont.

Trenton; town, at western end of the bay of Quinte, Hastings county, Ont.

Trepanege; plateau and river, west of Okanagan lake, Osoyoos district, B.C. (Not Deep creek nor Trepanier river.)

Trepanier. See Trepanege.

Triangle; lake, southeast of lake Nipigon, Thunder Bay district, Ont.

Trident; mountain, southwest of Kinbasket lake, Kootenay district, B.C.

Trident; point, on north shore of the bay of Quinte, Hastings Co., Ont. (Not Long.)

Trincomali; channel, between Galiano and Saltspring islands, southeast coast of Vancouver island, B.C. (Not Trincomalee nor Trincomalie.)

Trivet; point, on the northerly portion of Princess Royal island, Coast district, B.C.

Trodely; island, north of Charlton island, James bay, Que. (Not Little Charlton.)

Trois Bras. See Holden.

Trolltinder; mountain, south of mount Balfour, Kootenay district, B.C.

Troughton; island, Lake Fleet group, St. Lawrence river, Leeds county, Ont.

Trousers; lake, Lorne parish, Victoria county, N.B. (Not Tobique.)

Trout; creek, branch of McDame creek, Dease river, Cassiar district, B.C.

Trout. See Buntzen.

Trout. See Crean.

Trout. See Hayes.

Trout. See Peerless.

Truda; peaks, Hermit range, Selkirk mountains, Kootenay district, B.C.

Tsetelui; lake, at headwaters of Kakuchuya R., Cassiar district, B.C. (Not Tseteloui.)

Tshensagi. See Chensagi.

Tsichu; river, tributary to Gravel river, N.W.T. (Not Tsi-Choo.)

Tsinkut. See Sinkut.

Tuck; inlet, narrows, and point, north of Prince Rupert harbour, B.C. (Not Tuck's.)

Tucker; creek and lake, emptying into Allumette bay, Renfrew county, Ont.

Tudjakdjuan. See Resolution.

Tudjakdjudusirn. See Gabriel.

Tugwell; creek, west of Otter point, Juan de Fuca strait, Vancouver island, B.C.

Tuhulitas; inlet, north of Cyrus Field bay, N.W.T. (Not Toohoolitas.)

Tulameen; mountain, river, and village, Yale district, B.C. (Not Tulameen city.)

Tulip; creek, east of Lower Arrow lake, Kootenay district, B.C.

Tullin; mountain, west of outlet of Chilko L., Coast district, B.C. (Not Tull-in.)

Tulnustuk; river, Saguenay county, Que. (Not Todnustook nor Toolnustook.)

Tummeahai. See Tamihi.

Tummel; river, tributary to Pelly river, Yukon.

Tun; island, Blind bay, Halifax county, N.S. (Not Tuns.)

Tunagamik; lake, at headwaters of Ottawa river, Joliette county, Que.

Tunkwa; lake, Tp. 19, R. 21, W. 6 M., Kamloops district, B.C. (Not Toonkwa.)

Tunnussaksuk; point, east shore of Ungava bay, New Quebec.

Tupper; mount, also glacier in the Selkirks, Kootenay district, B.C.

Turn. See Dryad.

Turnagain; point, at entrance to Lynx bay, L. Winnipeg, Man. (Not Saskatchewan.)

Turner; mount, east of Stikine river and north of Iskut river, Cassiar district, B.C.

Turner. See Terence.

Turner. See Whitehorn.

Turnerville. See Ennett.

Turning; island, near S. point of Cove I., entrance to Georgian bay, Bruce Co., Ont.

Turquoise; lake, east of mount Balfour, Alberta.

Turret; peak, between Adamant and Austerity mountains, Adamant range of the Selkirks, Kootenay district, B.C.

Turtle; mountain, southwestern Manitoba.

Turtle; mountain, south of Frank, southwestern Alberta.

Turtle; point, on northerly portion of Gil island, Coast district, B.C.

Turtle. See Jarvis.

Tuscarora; post settlement and railway station, Brant Co., Ont. (Not Middleport.)

Tusket; island and village, Yarmouth county, N.S. (Not Great Tusket island.)

Tusket Wedge. See Wedgeport.

Tustles; lake, north of Frances lake, Yukon. (Not Tus-tles-tu.)

Tutchi. See Tutshi.

Tutesheta; creek, tributary to Tahltan river, Cassiar district, B.C. (Not Tuteshita.)

Tutshi; lake and river, S.E. of Bennett L. Cassiar dist., B.C. (Not Toochi nor Tutchi.)

Tuttle; point, at entrance to Stupart bay, Hudson strait, New Quebec.

Tuvalik; Indian village, west coast of Ungava bay, New Quebec.

Tuya; lake, and river tributary to Stikine river, Cassiar district, B.C. (Not Tooya.)

Tuzo; mount, east of Deltaform mountain, Bow range of the Rockies, Alta. and B.C.

Twelve Mile. See Bronte.

Twelve o'clock; point, at the eastern entrance to Murray canal, Murray township, Northumberland county, Ont.

Twenty-five Mile creek. See Harvey creek.

Twilight; lake, southwest of Cliff lake, Kenora district, Ont.

Twin; butte and creek, near Twin Butte railway station, Kootenay district, B.C.

Twin; falls, on the upper part of Yoho river, Kootenay district, B.C.

Twin; peaks, north of Columbia glacier, Rocky mountains, Alta. (Not The Twins.)

Twin. See Dunsmuir.

Twin. See Vrooman.

Twin Sisters; islands, Brock group, St. Lawrence river, Leeds county, Ont.

Twitya; river, tributary to Gravel river, N.W.T. (Not Twityeh.)

Two-bit; creek, east of Lower Arrow lake, Kootenay district, B.C.

Two Rivers; lake of, in Algonquin National park, Nipissing district, Ont.

Tyaughton; mountains, also river flowing into Bridge river, Lillooet district, B.C.

Tyee; lake and telegraph station, on trail near Bulkley river, Cassiar and Coast districts, B.C. (Not Long.)

Tyendinaga; township, Hastings county, Ont.

Tyers; river, tributary to Frances river, near Frances lake, Yukon.

Tyne; point, Departure bay, east coast of Vancouver island, B.C.

Tyrrell; lake, Tp. 5, Rs. 17 and 18, W. 4th M., southern Alberta. (Not Tyrrell's.)

Tzuhalem; mountain and post settlement, north of Cowichan river, Vancouver island, B.C. Not Tzouhalem.)

U

Uibvaksoak. See Uinaksoak.

Uinaksoak; cape, east shore Ungava bay, New Quebec. (Not Uibvaksoak.)

Unahini; river, tributary to Tatshenshini river, Yukon.

Unaminnikan. See Manomin.

Ungava; bay, in northern portion of the province of Quebec.

Unger; island, bay of Quinte, mouth of Napanee R., Lennox Co., Ont. (Not Unger's.)

Union; bay, east side of Saanich inlet, Vancouver island, B.C.

Unwin; mount, southwest of the narrows of Maligne lake, Rocky mountains, Alta.

Uphill; lake, northeast of Manitou lake, Kenora district, Ont. (Not Moonshine nor Kasakacheweiwak.)

Upinnakaw. See Opinnagau.

Upper Arrow; lake, an expansion of Columbia river, Kootenay district, B.C.

Upper Bow. See Bow.

Upper Emerald. See Yoho.

Upper Fishing. See Qu'Appelle.

Upper Kootanie. See Duncan.

Upper Lahave; village, Lunenburg county, N.S. (Not Upper La Have.)

Upper Manitou. See Anzhekumming.

Upper Nicola. See Nicola.

Upper Savage; islands, east of Big island, Hudson strait, N.W.T. (Not Savage.)

Upper White Fish. See Jarvis.

Urd; a peak of the Valhalla mountains, Kootenay district, B.C.

Ursula; channel, east of Gribbell island, Coast district, B.C.

Ursus Major; mountain, Hermit range, Selkirk mountains, Kootenay district, B.C.

Ursus Minor; mountain, Hermit range, Selkirk mountains, Kootenay district, B.C.

Usatzes; point, N.E. point of Low peninsula, Clayoquot sound, Vancouver I., B.C.

Uto; peak, near mount Sir Donald, Selkirk mountains, Kootenay district, B.C.

Uztlius; river, tributary to Anderson river, Yale district, B.C. (Not Uz-tli-hoos nor Uzvioos.)

V

Vadso; rock, off the southwest point of Larcom island, Observatory inlet, Cassiar district, B.C.

Valdes; island, in the southern portion of the strait of Georgia, B.C.

Valdes. See Maurelle, Quadra, and Sonora. Recent surveys proved that the name Valdes covered three islands, which have been named separately as above, and the former name has been discarded to avoid duplication.

Valhalla; mountains, west of Slocan lake, Kootenay district, B.C. (Not Val Halla.)

Valkyr; mountains, east of Lower Arrow lake, Kootenay, B.C. (Not Valkyriur.)

Valley; river, flowing easterly into Dauphin lake, Manitoba.

Valleyview; post office, north of Wapella, Sask. (Not Valley View.)

Valois; village, Jacques Cartier county, Que. (Not Valoisville.)

Valoisville. See Valois.

Vananda; cove and post settlement, Texada island, strait of Georgia, B.C. (Not Van Anda.)

Van Buren; island, northeast of Tar island, St. Lawrence river, Leeds county, Ont.

Vancouver; creek, tributary to McQuesten river, Yukon.

Van Hooven. See Van Houten.

Van Horne; brook, glacier, névé, and range of mountains, Kootenay district, B.C.

Van Houten; creek, E. of Lower Arrow L., Kootenay district, B.C. (Not Van Hooven.)

Vankoughnet; bay, east of The Narrows, L. Manitoba, Man.

Vansittart; island, northeast of Grenadier island, St. Lawrence river, Leeds Co., Ont.

Vaudray; lake, Vaudray township, Timiskaming county, Que. (Not Long.)

Vaudreuil; bay, railway station, rapids, and post village, also Vaudreuil Station post office, Vaudreuil county, Que. (Not Dorion.)

Vaux; mount, also glacier, northeast of Leanchoil station, Kootenay district, B.C.

Vedder; mountain, international boundary, New Westminster district, B.C.

Venn; passage between Metlakatla bay and Prince Rupert harbour, B.C.

Ventadour; lake, Quebec county, Que. (Not Kakisksagamak.)

Ventego; mountain, Selkirk range, Kootenay district, B.C.

Verdigris; coulée and lake, north of Milk river, southern Alberta.

Vermilion; bay and railway station, Eagle L., Kenora district, Ont. (Not Vermillion.)
Vermilion...See Little Vermilion.
Vermilion. See Pink.
Vermilion. See Red.
Verney; passage, between Hawkesbury and Gribbell islands, Coast district, B.C.
Vernon; creek and lake, at headwaters of Nimpkish river, Vancouver island, B.C.
Vertebrae; mountain, north of Bush river, Rocky Mts., Kootenay district, B.C.
Verte-Vallée; post office, Vaudreuil county, Que. (Not Green Valley.)
Vertical; mountain, east of Kootenay river, Kootenay district, B.C.
Vesuvius; bay, Saltspring island, southeast coast of Vancouver island, B.C.
Vesuvius; hill, north of Wheaton river, southern Yukon.
Victor; island, in Muchalat arm of Nootka sound, Vancouver island, B.C.
Victoria; mount, also glacier, in the Bow range of the Rockies, Alta., and Kootenay district, B.C. (Not Mt. Green.)
Victoria; island, N.W.T. Portions of this island have been known as 'Victoria Land," "Prince Albert Land," and "Wollaston Land."
Victoria; island, Brock group, St. Lawrence river, Leeds county, Ont. (Not Mile.)
Victoria; peak, northwest of Crown mountain, Vancouver island, B.C.
Victoria. See Broadback.
Vidette; peak, Sir Sandford range, Selkirk mountains, Kootenay district, B.C.
Vigilant; island, on north side of Prince Rupert harbour, B.C. (Not Bacon.)
Vigilant; rock, east of Grantham shoals, Manitoulin island, Manitoulin district, Ont.
Village Bélanger. See Bélanger.
Village Richelieu. See Richelieu.
Villanova; post office, Norfolk county, Ont. (Not Villa Nova.)
Villemontel; river tributary to Kinojevis river, Timiskaming county, Que. (Not Nawapitechin.)
Vingolf; mount, west of Slocan lake, Kootenay district, B.C.
Violadale; post village, Marquette electoral district, Man. (Not Viola Dale.)
Voisin (lac); lake, northeast of Taggart lake, central Saskatchewan.
Volcano; creek, tributary to Sheep river, southern Alberta.
Volunteer; spit, between Birch and Walker points, Manitoulin I., Manitoulin dist., Ont.
Von Wilczek; valley, on Lewes river, above Pelly river, Yukon.
Vowle; mount, west of Schwatka river, southern Yukon.
Vrooman; islands, McGregor cove, Bruce county, Ont. (Not Twin.)
Vulture; col, between mounts Gordon and Olive, Rocky mountains, Alberta.
Vulture. See Winnange.

W

Waagan. See Wagan.
Waagoosh. See Waugush.
Wabakimi; lake, northwest of Smoothrock lake, Thunder Bay district, Ont.
Wabamun; lake, south of St. Ann, central Alberta. (Not White Whale.)
Wabanoni; river, emptying into Obaska lake, Timiskaming, Que. (Not Wabinoni.)
Wabasca. See Wabiskaw.

Wabaskoutyunk. See Kempt.

Wabaskus; lake, southeast of Abitibi lake, Timiskaming county, Que.

Wabassi; brook, Templeton township, Ottawa county, Que.

Wabi; bay and creek, at the head of lake Timiskaming, Ont.

Wabigoon; lake, river, and railway station, Kenora district, Ont. (Not Wabigwunn.)

Wabigwunn. See Wabigoon.

Wabinoni. See Wabanoni.

Wabinosh; bay, lake, and river, on west side of L. Nipigon, Thunder Bay district, Ont.

Wabishkok; lakes, south of Kisseynew lake, Manitoba.

Wabiskaw; lakes and river, tributary to Peace river, northern Alberta. (Not Loon river nor Wabasca or Wabiscaw lakes.)

Waddell; bay, Frobisher bay, N.W.T. (Not Dyer sound.)

Wadopi; brook, tributary to upper Winisk river, Patricia district, Ont.

Wadsworth; lake, Tudor township, Hastings county, Ont.

Wagabkedei; lake, northwest of Attawapiskat lake, Patricia district, Ont.

Wagan; river, tributary to Restigouche R., Madawaska Co., N.B. (Not Waagan.)

Wagosh; bay and reef, Cockburn island, Manitoulin district, Ont. (Not Wahgoosh.)

Wagwabeya. See Wagwabika.

Wagwabika; lake, headwaters of Lièvre R., St. Maurice Co., Que. (Not Wagwabeya.)

Wahbiquekobing. See Wakwekobi.

Wahcomatagaming. See Wakomata.

Wahgoosh. See Wagosh.

Wahnapitae. See Wanapitei.

Wahquekobing. See Wakwekobi.

Wahwanichi. See Wakonichi.

Waiatt; bay, Okisollo channel, Coast district, B.C. (Not Wi-yat nor Wyatt.)

Wai-nusk. See Winisk.

Wainwright; basin, between S.E. end of Kaien I. and mainland, Coast district, B.C.

Waitabit; creek, flowing into Columbia river below Donald, Kootenay district, B.C.

Wajabakoute. See Chartier.

Wakamagaming. See Wakami.

Wakami; lake, river, and Ry. station, Sudbury district, Ont. (Not Wakamagaming.)

Wakaw; lake, northwest of Basin lake, central Saskatchewan. (Not Crooked.)

Wakeham; bay, southwest of Wales sound, Hudson strait, New Quebec.

Wakinichi. See Wakonichi.

Wakomata; lake, north of Gould township, Algoma district, Ont. (Not Clear nor Wahcomatagaming.)

Wakonichi; lake, south of Mistassini lake, Mistassini territory, Que. (Not Wahwanichi nor Wakinichi.)

Wakwekobi; lake, Day township, Algoma district, Ont. (Not Wahbiquekobing nor Wahquekobing.)

Walbran; point, north end of Loretta island, Devastation channel, Coast district, B.C.

Wales; cape, island, and sound, south shore of Hudson strait, New Quebec. (Not Prince of Wales.)

Walkem; islands, Johnstone strait, Coast district, B.C. (Not Pender.) This name adopted to avoid duplication, there being a Pender island further south.

Walker; creek, north of Sixtymile river, near international boundary, Yukon.
Walker; mount, north of Blaeberry, river, Rocky mountains, Kootenay district, B.C.
Walker; point, south shore Manitoulin island, Manitoulin district, Ont.
Walker; post office, Middlesex county, Ont. (Not Walker's.)
Walkhouse; bay and point, northeast of Inner Duck island, Manitoulin district, Ont.
Wallace; island, east of Lynedoch island, St. Lawrence river, Leeds county, Ont.
Wallace; island, N. of Saltspring I., S.E. coast of Vancouver I., B.C. (Not Narrow.)
Wallace; mount, southeast of Beaverdell, Similkameen district, B.C.
Wallace; mount, also river, south of Lesser Slave lake, central Alberta.
Wallace; rock, near South Baymouth, Manitoulin district, Ont.
Wallbridge; point, Ameliasburg township, Prince Edward county, Ont.
Wallenger; creek, tributary to Wild Horse river, Kootenay district, B.C.
Wall-eye; lake, south of Eagle lake, Kenora district, Ont.
Wallis; point, Nanoose harbour, east coast of Vancouver island, B.C.
Walsh; lake, north of Rosamond lake, Kenora district, Ont.
Walters; point, north shore of Okisollo channel, Coast district, B.C.
Walton; river and village, Hants county, N.S. (Not La Tete nor Petite.)
Wanapitei; lake, Ry. station, and river, Sudbury district, Ont. (Not Wahnapitae.)
Wanderer; shoal, southwest of Lyal island, Bruce county, Ont.
Wanipigow; river, emptying into the east side of lake Winnipeg, Man. (Not Hole.)
Wanogu; lake, Ledger township, Thunder Bay district, Ont. (Not Wanogooh.)
Wapageisi; lake, east of Anzhekumming lake, Kenora district, Ont.
Wapateehk. See Waputik.
Wapawekka; lake and range of hills, southeast of L. La Ronge, central Saskatchewan. (Not Bear lake nor Great Bear Sand hills.)
Wapiabi; creek, tributary to south branch of Brazeau river, Alta. (Not Grave.)
Wapichtigow. See Wapishtigau.
Wapikik. See Kapikik.
Wapikopa; lake and river, upper waters of Winisk river, Patricia district, Ont.
Wapishtigau; brook, tributary to Burntwood river, Manitoba. (Not Wapichtigow.)
Wapiti; river, tributary to Smoky river, central Alberta.
Wapitotem; river, between Attawapiskat and Weibikwei lakes, Patricia district, Ont.
Wapoos. See Wapus.
Wapoose. See Wapus.
Wapta; glacier, lake, and mountain, Rocky mountains, Kootenay district, B.C.
Wapta. See Cataract.
Wapta. See Kicking Horse.
Wapta. See Yoho.
Wapus; lake and river, N.W. of Kakagi lake, Kenora district, Ont. (Not Wapoose.)
Wapus; lake and river, east side of Reindeer lake, central Sask. (Not Wapoos.)
Wapusanan; lake, north of Grand lake Victoria, Timiskaming county, Que.
Wapustagamu; lake, on west branch of St. Augustin river, Saguenay county, Que. (Not Wapustagamoo.)
Waputik; mountains and snowfield, Rocky mountains, Kootenay district, B.C. (Not Wapateehk, Wap-ut-teehk, Waputehk, nor Waputehk.)

Ward; bay, in Aylmer lake, Wolfe county, Que. (Not Ward's.)

Ward; inlet, Frobisher bay, N.W.T. (Not A. H. Ward.)

Ward; lake, Rattray township, Timiskaming district, Ont.

Ward; mount, south of Wheaton river, southern Yukon.

Wardner; village, on Kootenay river, south of Bull river, Kootenay district, B.C.

Ware; creek, tributary to Sheep river, southern Alberta.

Ware; mount, northwest of mount Hoffman, southern Alberta.

Wark; channel, northeast side of Tsimpsean peninsula, also island at entrance to the channel, Coast district, B.C. (Not Work.)

Wark; island, northeast of Princess Royal island, Coast district, B.C.

Wark; mount, near head of Saanich inlet, Vancouver island, B.C. (Not Big Saanich, nor Work.)

Wark; point, in Victoria harbour, B.C. (Not Warke nor Work.)

Warner; bay and point, east of Hopkins point, Bruce county, Ont.

Warpath; river, emptying into the west side of L. Winnipeg, Man. (Not War Path.)

Warren; island, south of Beament island, Bruce county, Ont.

Warren; mount, south of southeast end of Maligne lake, Rocky mountains, Alberta.

Warwick; cape, east of Resolution island, N.W.T. (Not Resolution.)

Wasawakasik; lake, on Churchill river, below Nemei river, Sask.

Wascana. See Waskana.

Washademoak; river, tributary to St. John river, Queens county, N.B. (Not Washademoac nor Washedemoak.)

Washagami; river, tributary to Ekwan river, Patricia, Ont. (Not Washegummy.)

Washagomis; lake, south of Shabumeni lake, Patricia district, Ont. (Not Lower Clearwater.)

Washedemoak. See Washademoak.

Washegummy. See Washagami.

Washeibemaga; lake, southeast of Boyer lake, Kenora district, Ont. (Not Kawasheibemagagamak.)

Washeka; lake, upper Ottawa river, Pontiac county, Que. (Not Waskega.)

Washi; lake, on Albany river, east of Makokibatan lake, Patricia district, Ont. (Not Lake of the Narrows.)

Washikuti; bay and river, Saguenay county, Que. (Not Washsheecootai.)

Washimeska; river, Lake St. John county, Que. (Not Ouasiemska nor Wassienska.)

Washmawapta; glacier, E. of Helmet mountain, Rocky Mts., Kootenay district, B.C.

Washow; bay, in southern portion of lake Winnipeg, Manitoba.

Washsheecootai. See Washikuti.

Waskahigan; river, tributary to Little Smoky river, Alberta.

Waskaiowaka. See Waskatowaka.

Waskana; creek, flowing N.W. past Regina into Qu'Appelle R., Sask. (Not Wascana.)

Waskatowaka; lake, at headwaters of Little Churchill R., Man. (Not Waskaiowaka.)

Waskega. See Washeka.

Waskesiu; creek and lake, tributary to Montreal L., central Sask. (Not Red Deer.)

Waskik; lake, southwest of Sipiwesk lake, Manitoba. (Not Waskiktepigo.)

Waskiktepigo. See Waskik.

Waskwatim. See Wuskwatim.

Wasp; lake, Redditt township, Kenora district, Ont.

Wassienska. See Washimeska.

Waswanipi; H. B. Co.'s post, lake, also river tributary to Nottaway R., Abitibi, Que.

Watap; lake, west of Mountain lake, Int. boundary, Thunder Bay district Ont. (Not Rove.)

Watch; island, north of Hill island, St. Lawrence river, Leeds county, Ont.

Watcheeshoo. See Watshishu.

Watchi; lake, northeast of Reader lake, Manitoba. (Not Mountain.)

Waterfall; valley, at the head of Yoho river, Rocky Mts., Kootenay district, B.C.

Waterfowl; lakes, on Mistaya river, Rocky mountains, Alberta.

Waterhen; lake and river, between Manitoba and Winnipegosis lakes, Manitoba.

Waterton; lake and river, southern Alta. (Not Chief Mt. lake nor Kootenai river.)

Watsheeshoo. See Watshishu.

Watshishu; river, Saguenay county, Que. (Not Watcheeshoo nor Watsheeshoo.)

Watson; island, between S. end of Kaien I. and mainland, Coast district, B.C.

Watson; railway station, ridge, river, and valley, north of Bennett lake, Yukon.

Watt; railway station, Charlotte county, N.B. (Not Watt Junction.)

Watt Junction. See Watt.

Waugh; creek, tributary to Goldstream river, Vancouver island, B.C.

Waughs; river, Colchester county, N.S. (Not Wough's.)

Wauguash. See Kaniapiskau.

Waugush; lake, Spragge township, Algoma district, Ont. (Not Waagoosh.)

Wave. See Wavy.

Wavy; lake, north of Battle river, Alberta. (Not Wave.)

Wawagosik; lake, west of Harricanaw river, Abitibi territory, Que. (Not Wawagosic nor Wawagosie.)

Waweig; lake, northwest of Wabinosh lake, Thunder Bay district, Ont.

Wawiag; river, Rainy River and Thunder Bay districts, Ont. (Not Kawawiagamak.)

Wawong; lake, near Windigokan L., E. of L. Nipigon, Thunder Bay district, Ont.

Way; point S.W. of Potter point, Ameliasburg Tp., Prince Edw. Co., Ont. (Not Salt.)

Wayagamak; lake, Champlain county, Que. (Not Wayagamack.)

W. D. Smith's island. See Henry island.

Weaver; creek, tributary to Moyie river, Kootenay district, B.C.

Wedding; river, tributary to Bell river, Abitibi territory, Que.

Wedge; island, east of Dokis island, at entrance to Key harbour, Georgian bay, Parry Sound district, Ont.

Wedge; point, Ladysmith harbour, east coast of Vancouver island, B.C.

Wedgeport; village, Yarmouth county, N.S. (Not Tusket Wedge.)

Wedgwood; mount, northeast of mount Assiniboine, Rocky mountains, Kootenay district, B.C.

Wedlock; island, Admiralty group, St. Lawrence river, Leeds county, Ont.

Weed; hills, southeastern Saskatchewan.

Weenisk. See Winisk.

Weese; creek, Brighton township, Northumberland county, Ont. (Not Weese's.)

Weggs; cape, south shore of Hudson strait, New Quebec.

Weibikwei; lake, at head of Winisk river, Patricia district, Ont. (Not Pepisquew nor Winisk.)

Weir. See Footprint.

Weir. See Hennigar.

Weiseieno; lake, near Manitou lake, Kenora district, Ont.

Wekusko; lake, Grass river, east of Reed lake, Man. (Not Herb nor Sweet Herb.)

Welcome; lake, Lawrence township, Haliburton county, Ont.

Welland; river, Welland county, Ont. (Not Chippewa.)

Wellandport; post office, Lincoln county, Ont. (Not Welland Port.)

Weller; bay, near west end of bay of Quinte, Prince Edward Co., Ont. (Not Weller's.)

Wellesley; lake, west of White river, Yukon.

Wellington; bay and village, Prince Edward county, Ont. (Not Big Sandy bay.)

Wells; shoal, southeast of Lyal reef, Bruce county, Ont.

Welsh; bank, north of Scott point, Bruce county, Ont.

Welshpool; village, on Friar bay, Campbello island, Charlotte county, N.B. (Not Campo Bello, Welchpool, nor Welsh-Pool.

Wemistagosew; river, upper waters of Waswanipi river, Abitibi territory, Que.

Wenasaga; river, flowing into L. Seul, Patricia district, Ont.

Wendigokan. See Windigokan.

Wenkchemna; peaks, in the Bow range of the Rockies, Alta. and Kootenay district, B.C. (Not Desolation range nor "The Stragglers.")

Wepiskow. See Burntwood.

Wesketahin; village, near the mouth of Unahini river, Yukon.

Weslemkoon; lake, Addington county, Ont.

West; bay, the western extremity of lake Evans, Abitibi territory, Que.

West; river, Bonaventure county, Que. (Not West Port Daniel river.)

West; river, Pictou county, N.S. (Not West river of Pictou.)

West; river, tributary to Fraser river, above Quesnel, Cariboo district, B.C.

West. See Nelson.

West. See Owen.

West. See Torres.

West Arrowwood; creek, tributary to Bow R., S. Alberta. (Not West Arrow-wood.)

West Belanger. See Belanger.

Westboro; post office and summer resort, Carleton county, Ont. (Not Westborough.)

Westbourne; bay, north shore of Hudson strait, N.W.T.

Westbourne; post settlement, on Whitemud river, south of L. Manitoba, Man.

West Branch of Don (river). See Don.

West Branch of Gold river. See Palmer creek.

West Branch of Tobique (river). See Sisson.

West Dog Head. See Whiteway.

West Duck; reef, northwest of Western Duck island, Manitoulin district, Ont.

Western; river, emptying into Coronation gulf, N.W.T. (Not Back's Western.)

Western Duck; island, of the Duck group, Manitoulin district, Ont.

West Flamboro. See Flamboro West.

West Flamborough. See Flamboro West.

West Fork of Bull river. See Galbraith creek.
West Fox. See Fox.
Westholme; post settlement, south of Chemainus river, Vancouver island, B.C.
West McGillivray. See McGillivray.
West Niskitogisew. See Kiskitto.
West Passage. See Barrington Passage.
West Port Daniel. See West.
West river of Pictou. See West.
West Road (river). See Blackwater.
West Sister; shoal, S. of Yeo I., entrance to Georgian bay, Manitoulin district, Ont.
West Winisk. See Asheweig.
Wetetnagami; lake, and river tributary to Opawika river, Abitibi and Pontiac, Que.
Wettigo; lake, south of Nemiskau lake, Mistassini territory, Que.
Weymontachi; Inlian village, at the mouth of Manuan river, upper St. Maurice river, Champlain county, Que. (Not Weymontachingue.)
Whale; river, emptying into Ungava bay, New Quebec.
Whaleback; mountain, at the headwaters of Yoho river, Rocky mountains, Kootenay district, B.C. (Not Whalesback.)
Whaler; bay, Active pass, strait of Georgia, New Westminster district, B.C.
Wharton; harbour, north shore of Hudson strait, N.W.T.
Whatshan; lakes and river, west of Lower Arrow lake, Kootenay district, B.C.
Wheaton; mount, in the "big bend" of Wheaton river, southern Yukon.
Wheaton; river, emptying into the west side of Bennett lake, Yukon.
Wheaton Vault; brook, flowing into Minas channel, Kings county, N.S.
Wheeler; creek, tributary to Michel creek, Kootenay district, B.C.
Wheeler; mount, Purity range, Selkirk mountains, Kootenay district B.C.
Wheeler; reef, southwest of Kitchener island, Manitoulin district, Ont.
Whetstone; lake, Lake township, Hastings county, Ont.
Whiffen; spit, Sooke inlet, Vancouver island, B.C.
Whipple; mount, east of the elbow of Stikine river, Cassiar district, B.C.
Whipsaw; creek, flowing northeasterly into Similkameen river, Yale district, B.C.
Whirlpool; river, flowing from Athabaska pass northerly into Athabaska river, Alta.
Whirlpool. See Sunwapta.
White. See Ketch.
White Bear; bay, northeast of Markham bay, Hudson strait, N.W.T.
Whitebear; lake, north of Saskatchewan Landing, southern Sask. (Not White Bear.)
White Bear; lake and river, at headwaters of Gatineau river, Champlain county, Que.
White Bear. See Cassels.
Whiteclay; lake, Ogoki river, east of Whitewater lake, Thunder Bay district, Ont.
White; cliff, northeast of Hungerford point, Manitoulin I., Manitoulin district, Ont.
White Douglas; the southerly peak of mount Douglas, Rocky mountains, Alberta.
Whitefish. See Garson.
Whitefish. See LaSarre.
Whitefish. See Meacham.
Whitefish Spawning. See Chukuni.

Whitefox; river, tributary to Torch river, central Saskatchewan. (Not White Fox.)

White Goat. See Cline.

Whitegoose; river, tributary to Migiskan river, below Paskagama lake, Pontiac county, Que. (Not White Goose.)

White Grouse; creek, east of Whatshan lake, Kootenay district, B.C.

Whitehorn; mountain, northwest of mount Robson, Cariboo district, B.C. (Not Turner nor White Horn.)

Whitehorse; town and rapid, Lewes river, below Miles canyon, Yukon. (Not White Horse.)

White Man; pass, Rocky Mts., Alta. and Kootenay district, B.C. (Not White Man's.)

White; mount, north of Atlin lake, Yukon.

Whitemouth; lake and river, tributary to Winnipeg river, also village, Manitoba. (Not White Mouth.)

Whitemud; river, flowing into the southerly end of lake Manitoba, Man. (Not White Mud nor White-mud.)

White Mud. See Frenchman.

White; pass, at head of Skagway river, Cassiar district, B.C.

White; river, tributary to Yukon river, above Stewart river, Yukon.

Whiterock; post office, Kings county, N.S. (Not White Rock Mills.)

White Rock Mills. See Whiterock.

Whites; post office, Kings county, N.S. (Not White's Corner.)

Whites; post office and railway station, Huntingdon county, Que. (Not White's nor White's Station post office.)

White's. See Geikie.

Whitesand; lake and river, emptying into northerly end of lake Nipigon, Thunder Bay district, Ont.

Whitesand; post office and river, southeastern Saskatchewan. (Not White Sand.)

White's Corner. See Whites.

Whiteshell; lake and river, emptying into Winnipeg river, Manitoba.

Whiteshore; lake, east of Tramping lake, Saskatchewan. (Not White Shore.)

White's Station. See Whites.

Whitestone; lake, north of Cat lake, Patricia district, Ont.

Whitestone; river, tributary to Tatshenshini river, southwestern Yukon.

White; strait, north shore of Hudson strait, N.W.T.

Whiteswan; river, emptying into Teslin L., Cassiar district, B.C. (Not White Swan.)

Whitewater; lake, southwestern Manitoba.

Whitewater. See Taseko.

Whiteway; point, at west side of north entrance to the narrows of lake Winnipeg, Man. (Not Dog's Head nor West Dog Head.)

White Whale. See Wabamun.

Whitewood; lake, Tp. 29, R. 17, W. 2 M., southeastern Saskatchewan.

Whitewood. See Basswood.

Whitford; lake, in Tp. 56, Rs. 15 and 16, W. 4th M., Alberta.

Whitley; bay, northwest of Burgoyne bay, Hudson strait, New Quebec.

Whitney; lake, Smellie township, Kenora district, Ont.

Wholdaia; lake, an expansion of Dubawnt river, N.W.T. (Not Wholdiah.)

Whymper; mount, northwest of Storm mountain, Rocky mountains, Alberta.

Whymper; mount, near head of Chemainus river, Vancouver island, B.C.

Whymper. See Kiwetinok.

Whyte; mount, west of lake Louise, Alberta.

Wiachuan; river, Richmond gulf, New Quebec. (Not Wiachewau nor Wiachouan.)

Wicked; point, Athol township, Prince Edward county, Ont. (Not Salmon.)

Wickens; lake, Britton township, Kenora district, Ont.

Wickham; post office and railway station, Drummond Co., Que. (Not Wickham West.)

Wickham West. See Wickham.

Wicksteed; rock S.E. of Dead I., entrance to Key har., Georgian B., Parry S. dist, Ont.

Wigwam; river, tributary to Elk river, Kootenay district, B.C.

Wigwas. See Eva.

Wigwasan; lake, west of Bukemiga lake, Thunder Bay district, Ont.

Wigwasikak; lake, northwest of Cat lake, Patricia district, Ont. (Not Birch.)

Wikwaskapauk. See Mourier.

Wilcocks; lake, Whitchurch township, York Co., Ont. (Not Wilcox nor Willcocks.)

Wilcox; lake, English river, Kenora district, Ont.

Wilcox; pass and peak, north of Mt. Athabaska, Rocky mountains, Alberta.

Wild; bight, in west side of Fitzwilliam island, Manitoulin district, Ont.

Wild Horse; river, tributary to Kootenay R., Kootenay district, B.C. (Not Skirmish.)

Wilkinson; creek, tributary to the west fork of Kettle river, above Carmi, Similkameen district, B.C.

Willard; lake, north of Hawk lake, Kenora district, Ont.

Willcocks. See Wilcocks.

William; head, at north entrance to Pedder bay, Vancouver island, B.C.

Williams; bay, south shore of L. Seul, Kenora district, Ont.

Williams; lake, east of Fraser river, in the southern portion of Cariboo district, B.C.

Williams; lake, east of Cat lake, Patricia district, Ont.

William Smith; cape, northeast shore of Ungava bay, New Quebec.

Willoughby; island, northeast of Grenadier island, St. Lawrence river, Leeds Co., Ont.

Willowbank; creek and mountain, W. of Blaeberry R., Rocky Mts., Kootenay, B.C.

Willowbunch; lake and post office, southern Saskatchewan. (Not Willow Bunch.)

Willowgrove; post office, Haldimand county, Ont. (Not Willow Grove.)

Wilson; mount, also glacier, north of Mt. Murchison, Rocky mountains, Alberta.

Wilson; mount, also lake, Ross river, Yukon.

Wilson; post office, Grenville county, Ont. (Not Wilson's Bay.)

Wilson; post office, northwest of Chemainus river, Vancouver island, B.C. (Not Wilson's Crossing.)

Wilson; river, flowing easterly into Dauphin lake, Manitoba.

Wilson. See Kiwetinok.

Wilson Corners; post office, Wakefield Tp., Ottawa Co., Que. (Not Wilson's Corners.)

Wilson's Bay. See Wilson.

Wilson's Crossing. See Wilson.

Wiltse; lake, Leeds county, Ont. (Not Wiltz nor Wiltze.)

Wiltshire; village, Queens county, P.E.I. (Not New Wiltshire nor North Wiltshire.)

Wimapedi; brook, tributary to Burntwood river, Manitoba.

Winawiash; lake, southwest of Grand lake Victoria, Timiskaming county, Que.

Wind; mountain, west of Kananaskis river, Rocky Mts. park, Alta. (Not Windy.)

Windermere; lake and town, at headwaters of Columbia river, Kootenay district, B.C. (Not Lower Columbia lake.)

Windigo; bay and islands, north shore of lake Nipigon, Thunder Bay district, Ont.

Windigo; lake and river, tributary to Severn river, Patricia district, Ont.

Windigokan; lake, E. of L. Nipigon, Thunder Bay district, Ont. (Not Wendigokan.)

Windy; arm, Tagish lake, Yukon.

Windy; lake, southwest of Oxford lake, Manitoba.

Winefred; lake and river, tributary to Christina river, eastern Alberta.

Winging; point, east headland of Fourchu bay, opposite Guyon island, Cape Breton county, N.S. (Not Wining nor Winning.)

Wining. See Winging.

Winisk; lake and river, Patricia district, Ont. (Not Wai-nusk nor Weenisk.)

Winiskisis; river, tributary to upper Winisk river, Patricia district, Ont.

Winnange; lake, north of Dryberry lake, Kenora district, Ont. (Not Vulture.)

Winning. See Winging.

Winnipegosis; a large lake in Manitoba. (Not Winnipegoos nor Winnipegoosis.)

Winonitikameg; lake, northwest of Attawapiskat lake, Patricia district, Ont.

Wintawanan; lake, southwest of Attawapiskat lake, Patricia district, Ont.

Wintego; lake, an expansion of Churchill river, below Reindeer river, Sask.

Wintering; lake, west of Landing lake, Manitoba.

Witchai; lake, on lower Grass river, Manitoba.

Witchekan; lake, in the Thickwood hills, central Saskatchewan.

Wiwa; creek, flowing easterly into Wood river, southern Saskatchewan.

Wiwaxy; peaks, southwest of mount Victoria, Rocky mountains, Kootenay, B.C.

Wi-yat. See Waiatt.

Wizida; lake, at headwaters of Attawapiskat river, Patricia district, Ont.

Wizidans; lake, at headwaters of Attawapiskat river, Patricia district, Ont.

Woden; a peak of the Valhalla mountains, Kootenay district, B.C.

Wolf; canyon, on Pelly river, above Woodside river, Yukon.

Wolf; creek, tributary to Klondike river, Yukon.

Wolf. See Grimsthorpe.

Wolf. See Muhigan.

Wolfe; island, St. Lawrence river, Frontenac county, Ont. (Not Long.)

Wolfe; island, south of De Stein point, Prince Rupert harbour, Coast district, B.C.

Wolfe Island; township and village, on Wolfe island, Frontenac county, Ont. (Not Marysville village.)

Wolf Rand. See Muhigan.

Wolfestown; township and village, Wolfe county, Que. (Not Wolfstown.)

Wollaston; peninsula, S.W. portion of Victoria I., N.W.T. (Not Wollaston Land.)

Wollaston Land. See Victoria island.

Woman; lake and river, south of Shabumeni lake, Patricia district, Ont. (Not Woman Lake river.)

Wood; brook, tributary to Grass river, Manitoba.

Wood; mount, west of Saanich inlet, Vancouver island, B.C.

Wood; mountain and river, also Wood Mountain post office and R.N.W.M. Police station, southern Saskatchewan. (Not Wood Mountain river.)

Wood. See Jacob.

Woodley; range of mountains, west of Kulleet bay, Vancouver island, B.C.

Wood Mountain river. See Wood river.

Woodroffe; post office and summer resort, Carleton county, Ont. (Not Woodroofe nor Woodruff.)

Woods; island, Ladysmith harbour, Vancouver island, B.C. (Not Long.)

Woods; lake of the, on international boundary, Kenora and Rainy River districts, Ont.

Woods. See Carroll Wood.

Woodside; river, tributary to Upper Pelly river, Yukon.

Woodtick; island, St. Clair river, Lambton county, Ont. (Not Fawn.)

Woody; river, flowing northeasterly into Swan lake, Manitoba and Saskatchewan.

Work. See Wark.

Worthington; creek, west of Lower Arrow lake, Kootenay district, B.C.

Wotan; mount, Adamant range, Selkirk mountains, Kootenay district, B.C.

Wotinimata; lake, east of Shabogama lake, Pontiac county, Que.

Wreck; point, southwest of Tobermory harbour, Bruce county, Ont.

Wrench; lake, northeast of Carlton, central Saskatchewan.

Wright; creek, west end of Surprise lake, Cassiar district, B.C.

Wright; creek, tributary to Blanche river, Timiskaming district, Ont.

Wright; point, north of Goderich, Huron county, Ont.

Wright; sound, between Gil and Gribbell islands, Coast district, B.C.

Wunnummin; lake, upper waters of Winisk river, Patricia district, Ont.

Wuskatasko; brook, tributary to Grass river, Manitoba.

Wuskwatim; brook and lake, on Burntwood river, Manitoba. (Not Beaver-dam, Ooskootim, nor Waskwatim.)

Wyatt. See Waiatt.

Wynott; point, N.E. of Head harb., St. Margaret bay, Halifax Co., N.S. (Not Smith.)

X

Xschwan. See Granby

Y

Yahk; mountain, river, and railway station, in S.W. portion of Kootenay district, B.C.

Yalakom; game reserve, between north fork of Bridge river and the Fraser, Lillooet district, B.C.

Yarrell; mount, in southeastern portion of Kootenay district, B.C.

Yawningstone; lake, north of Cormorant lake, Manitoba.

Yellow; point, northeast of Kulleet bay, Vancouver island, B.C.

Yeo; channel, island, and spit, at entrance to Georgian bay, Manitoulin district, Ont.

Yeo; island, southwest of Grenadier island, St. Lawrence river, Leeds county, Ont. (Not Bluff nor Old Bluff.)

Yeth; creek, tributary to Inklin river, Cassiar district, B.C.

Yoho; glacier, lake, park, pass, peak, and river, Rocky mountains, Kootenay district, B.C. (Not Collie glacier, Glacier creek, North Fork river, Upper Emerald lake, nor Wapta lake and pass.)

York; river, trib. to Madawaska R., Hastings and Renfrew Cos, Ont. (Not York Brch.)

York; sound, in southwest portion of Frobisher bay, N.W.T.

Yorke; island, Admiralty group, St. Lawrence river, Leeds Co., Ont. (Not Boss Dick.)

Youell; island, east of Hopkins point, Bruce county, Ont.

Young; lake, in S.W. portion of Dalton Tp., Victoria Co., Ont. (Not Montgomery.)

Youngs; point, Weller bay, Ameliasburg township, Prince Edward county, Ont.

Young's. See Limestone.

Yukness; mount, southwest of mount Lefroy, Kootenay district, B.C.

Yukon; river and territory, N.W. Canada. (Not Youcon, Youkon, Kwichpak, &c.)

Z

Zachariah; point, near Dodd narrows, east coast of Vancouver island, B.C.

Zanardi; rapids, at S.W. end of Wainwright basin and S. of Kaien I., Coast dist, B.C.

Zemawdza; Indian village, Kitimat arm, Coast district, B.C. (Not Ze-mawd-za.)

Zenazie; creek, south of Gladys lake, Cassiar district, B.C.

Zero; rock, in Haro strait, N.E. of Gordon head, S.E. coast of Vancouver I., B.C.

Zinc; mountain and valley, east of Ice river, Rocky mountains, Kootenay district, B.C.

Zinkan; island, Pine Tree harbour, Bruce county, Ont.

Zwick; island, in the bay of Quinte, Hastings county, Ontario. (Not Zwick's.)

Zymoetz; river, tributary to Skeena river, Coast district, B.C. (Not Copper.)

INDEX.

NAMES ARRANGED FOR PROVINCES, COUNTIES, ETC.

ALBERTA.

Aberdeen
Abbot
Agnes
Akuinu
Alberta
Alexandra
Alice
Allan
Altrude
Annette
Arcs
Arrowwood
Askow
Assiniboine
Athabaska
Athabaska Landing
Athabasca
Atikkamek
Attim Segoun
Avens
Aylmer
Baker
Balfour
Baptiste
Barwell
Bath
Battle
Bear
Beaupré
Beaver
Beaver
Beaverdam
Beaverhill
Beaverlodge
Belly
Biddle
Bident
Big Egg
Bighill
Bighorn
Bismarck
Blackfoot
Black Douglas
Blackstone
Blakiston
Bluff
Boom
Bosworth
Boulder
Bourgeau
Bow
Bow Island
Boyer
Brachipod
Brazeau
Brett
Bruce
Brulé
Bryce
Buffalo
Buffalo
Bull
Bullpound
Cameron
Castle
Castor
Cataract
Cataract
Chaba
Charlton
Chief Mountain
Chin
Chiniki
Chip
Chipewyan
Christie
Christina
Chungo
Cirque
Clearwater
Cline
Cockscomb
Cold
Coldwater
Coleman
Columbia
Cone
Consolation
Cooking
Corral
Costigan
Coutts
Crowfoot
Growlodge
Crowsnest
Cyclone
Cypress
Deltaform
Desolation
Devils Head
Devil's Head
Devil's Pine
Dirt
Dolomite
Douglas
Dowling
Driedmeat
Driftpile
Drummond
Dunvegan
Duplex
Dutch
Dyson
Eagle
Eagle
Eaglenest
Echafaud
E. Arrowwood
E. Br. Athabaska R.
Edmonton
Ego
Eiffel
Eighteen-Mile
Elbow
Elkwater
Elliott
Embarras
Emerald
End
Etsi-kom
Etzikom
Eyehill
Fairholme
Fairview
Farrell
Farrier
Fatigue
Fawcett
Fay
Fish
Fisher
Flagstaff
Folding
Forbes
Fork
Fort Chipewyan
Fort Dunvegan
Fort Edmonton
Fort McKay
Fort Macleod
Fort McMurray
Fort Smith
Fortress
Fort Vermilion
Fossil
Freemen
Freman's
Frenchman
Frog
Garson
George
Ghost
Ghost
Ghostpine
Girouard
Glacier
Glacier
Goat
Goat
Goldsmith
Goose
Gordon
Gorge
Gough
Gould Dome
Grande-Prairie
Grand Valley

ALBERTA—*Continued.*

Grave
Green
Gregg
Grizzly Bear
Grotto
Haddo
Hamilton
Hanalta
Hand
Hardisty
Harrison
Hastings
Haven
Hazel
Head
Heart
Hector
Helen
High
Highwood
Hoffman
Horse
Horseshoe
House
House
Howse
Huber
Hungabee
Inglismaldie
Inverness
Iosegun
Iron
Isabella
Island
Isle
Jacob
James
Jarvis
Jonas
Jumpingpound
Junction
Ka-koot
Kakut
Kananaskis
Katherine
Keheewin
Kehiwin
Kenilworth
Kerkeslin
Kipp
Kirkpatrick
Knee
Kneehill
Kneehills
Kootanie
Kootenai
LaBiche
Lacroix
Laggan
Landels
La Nonne
Leah
Lee
Lefroy
Lesser Slave
Lineham
Little
Little Bow
Little Brazeau
Little Fork of Sask.
Little Smoky
Little Vermilion
Livingstone
Lobstick
Lodge
Lonely Valley
Long
Louis
Louise
Lower Bow
Lower Whitefish
Lusk
Lychnis
Lyell
Macabee
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McKay
McLeod
Macleod
McMurray
Mahmee
Maligne
Mami
Margaret
Marmot
Martin
Martineau
Mary Vaux
Medicine
Medicine Lodge
Medicine Lodge
Merlin
Middle Branch (Highwood R.)
Milk
Ministik
Minnewanka
Miquelon
Mire
Mirror
Missawawi
Mist
Mistaya
Misty
Moberly
Mokowan
Molar
Moose
Moraine
Murchison
Muriel
Murray
Namaka
Neutral
Newman
Niblock
Nikanassin
Noores
Nordegg
Norquay
North Fork
North Heart
North Kootenay
North Vermilion
Nose
Noyes
Observation
Okotoks
Old Fort
Oldman
Olive
Opabin
Opal
Otauwau
O-Tow-Wow
Owl
Oyster
Paddle
Paddle
Pak-oghke
Pakowki
Panther
Paradise
Pass
Paul
Peace
Peechee
Peekopee
Peerless
Pekisko
Pembina
Pembina
Peyto
Piegan
Pigeon
Pika
Pinnacle
Pipe
Pipestone
Pt. Brulé
Poboktan
Popes
Porcupine
Portal
Pothole
Pouce Coupé
Primrose
Protection
Ptarmigan
Pulpit
Pulsatilla
Rae
Rainy
Ram
Raven
Red
Red Deer
Red Deer
Redoubt
Redwater
Ribstone
Richardson
Roche de Smet
Roche Suett
Rocky
Rolph
Rosebud
Ross
Rundle
Saddle
St. Ann
St. Mary
St. Nicholas
St. Piran
Sakwatamau
Samson
Sarcee
Saskatchewan
Saulteux
Sauteur
Sauteux
Savasse Berry
Sawback
Sentinel
Serviceberry
Sevenpersons
Shanks
Shaver
Sheep
Sheol

ALBERTA—*Concluded.*

Shunda
Sibbald
Siffleur
Silverhorn
Simonette
Simpson
Sinking
Skoki
Slave
Small
Smith
Smoky
Snake
Sounding
S. Brch. (Highwood R.)
Southesk
South Heart
Spencer
Spirit
Spray
Sprucegrove
Square
Steepbank
Sterling
Stewart
Stimson
Stirling
Stonyplain
Storm
Stutfield
Sullivan
Sulphur
Sunwapta
Sutherland
Swan
Swan
Sweathouse
Sylvan
Table
Tekarra
Temple
Ten Peaks
Tent
The Beehive
The Goat's Looking Glass
The Mitre
Thérien
The Saddle
The Stragglers
The Twins
Thompson
Threehills
Threepoint
Three Sisters
Tilted
Tombstone
Tower of Babel
Trail
Trout
Turquoise
Turtle
Tuzo
Twin
Tyrrell
Unwin
Upper Bow
Upper Whitefish
Verdigris
Vermilion
Victoria
Volcano
Vulture
Wabamun
Wabasca
Wabiskaw
Wallace
Wapiabi
Wapiti
Ware
Warren
Waskahigan
Waterfowl
Waterton
Ware
Wavy
Wenkchemna
W. Arrowwood
Whirlpool
Whirlpool
White Douglas
Whitefish
White Goat
White Whale
Whitford
Whymper
Whyte
Wilcox
Wilson
Wind
Winefred

BRITISH COLUMBIA.

(*Names arranged for Land Districts.*)

Cariboo.

Alexis
Anaham
Anahim
Athabaska
Battle
Bear
Black
Blackwater
Bobtail
Bowron
Canyon
Cariboo
Caribou
Chetang
Chilako
Chilanco
Chilanko
Chilco
Chilcote
Chilcotin
Chilko
Chimney
Chown
Eulatazella
Fort Nelson
Fort St. John
Français
François
Fraser
Helena
Kinney
Moberly
Mowat
Mud
Mumm
Naltesby
Nechako
Nelson
Ormonde
Pantage
Pelican
Ptarmigan
Quesnel
Riske
Robson
Sicannie Chief
Sikanni Chief
Sinkut
Stewart
Stuart
Tatei
Titkana
Tsinkut
Turner
West
West Road (river)
Whitehorn
Williams

Cassiar

Ahwillgate
Aiskew
Alsek
Anuk
Anvil
Arthur Seat
Atlin
Awillgate
Babine
Barham
Bastion
Beady
Bear
Bear
Beaton
Beaver
Bee
Bennett
Bernard
Black
Blanchard
Blue
Boofus
Boulder
Brown Dome
Buck
Buckley
Bulkley
Cameron
Canyon
Carter
Cassiar
Chehalis
Chikoida
Chismaina
Choquette
Clearwater

BRITISH COLUMBIA—*Continued.*

Cassiar—*Con.*

Cone
Consolation
Copper
Cottonwood
Crater
Davenport
Dease
Deep
Dixie
Dudidonto
Eagle
Eagle Crag
Edgar
Edmund
Egnell
Eightmile
Elbow
Ewing
Fantail
Farnsworth
Fifteen-mile
Français
François
Gladys
Glave
Glenora
Goat
Goodwin
Goose
Gordon
Graham
Granby
Gun
Hackett
Halcro
Hale
Hall
Harold
Hartz
Hatchau
Hatin
Hayes
Hazelton
Heart
Hendon
Hitchcock
Homan
Hotailuh
Hurricane
Hutsigola
Hyland
Ice-cap
Inklin
Iskut
Jennings
Johnson
Kaha
Kahtate
Kaketsa
Kakuchuya
Kates Needle
Katina
Kennicott
Kelsall
Ketchum
Kinaskan
Kispiox
Kitgargas
Kitwanga
Klootchman
Knob
Kluchman
Koketsa
Koshin
Kuldo
Kuthai
Kwadacha
Lacroix
Laketon
Laura
Laurie
Lecroix
Leonard
Lina
Lindeman
Lyndeman
Little Tahltan
Llewellyn
Long
McCallum
McDame
McDonald
McGrath
Macha
McIntosh
McKee
McLay
McLeod
McMaster
Mansfield
Marble Dome
Maria
Matsatu
Middle
Minto
Mountain
Muchuya
Munro
Mussen
Naas
Nadahini
Nakina
Nakonake
Nass
Nasse
Nelson
Nevin
North
Observation
O'Donnel
O'Keefe
Omenica
Omineca
Otter
Paradise
Parton
Pereleshin
Peveril
Pike
Plateau
Porcupine
Porphyry
Porter
Porter's Landing
Quartz
Robertson
Rocher Déboulé
Round
Ruby
Ruth
Saddle
Sanford
Sawback
Scud
Shakes
Shallow
Sharpe
Shegunia
Sheslay
Sicanni Chief
Sikanni Chief
Silver Salmon
Skeena
Skena
Slocoh
Sloko
Snowcap
Snowdon
Snowy
Stanley
Stick-ah-din
Stikyadin
Stikine
Stovel
Sucker
Sugarloaf
Sullivan
Summit
Sunday
Surprise
Suskwa
Tacho
Tagish
Tahltan
Taku
Taku
Talaha
Tanzilla
Tatiki
Tatshenshini
Tatsho
Tattiki
Tawina
Taysen
Telegraph
Telkwa
Teresa
Terrahina
Teslin
The Knob
Thibert
Toochi
Tooya
Torres
Tory
Trout
Tsetelui
Turner
Tutchi
Tutesheta
Tutshi
Tuya
Tyee
Vadso
West
Whipple
White
Whiteswan
Xschwan
Yeth
Zenazie

Coast.

Amy
Antonio
Arm
Ashton

BRITISH COLUMBIA—*Continued.*

Coast—*Con*

Babine
Bacon
Bacon
Barnes
Barrett
Beatty
Bellabella
Bellakula
Birkby
Bishop
Bjerre
Blackney
Black
Blackwater
Blakeney
Bodega
Boundary
Boxer
Bramham
Branham
Buckley
Bulkley
Burns
Burroughs
Butze
Cahnish
Calete
Cardero
Cascade
Casey
Charles
Chassepot
Cheslatta
Chickens
Chilanco
Chilanko
Chilco
Chilcote
Chilko
China Hat
Choelquoit
Chonat
Clio
Cloyah
Coast
Comblain
Connolly
Cooper
Copper
Cordero
Coste
Crease
Cumming
Cundale
David
Dawkins
Dean
Decker
Defot
Delusion
Denise
De Stein
Dodge
Dokdaon
Dorothy
Douglas
Driftwood
Dryad
Dundas
DuVernet
Eagle
Ecstall
Ecstew
Eddy
Edgell
Eliot
Elizabeth
Ellinor
Elliot
Emilia
Emmerson
Endako
Essington
Etta
Eva
Exstew
Fairview
Falcon
Farewell
Fern
Fisherman
Flat
Fort Fraser
Fort James
Fort St. James
Francisco
Fraser
Frederick
Galloway
Garden
Gardner
Gandin
Georgia
Gertrude
Ghost
Gil
Gobeil
Graeme
Gramophone
Grant
Gribbell
Grindstone
Guard
Guard
Gurd
Hall
Hallett
Halsey
Hawkesbury
Hays
Hays
Hecate
Hecate
Helen
Hibben
Hill
Hippa
Hockstall
Holmes
Homalko
Homathko
Home
Hopkins
Horsfall
Hubert
Huckstall
Hudson Bay (Mt.)
Hurstall
Ikeda
Ingraham
Inverness
Islet
Joassa
Jorkins
Kaien
Kaiete
Ka-its-siks
Kanish
Kasiks
Kathlyn
Kerr
Kersey
Kestrel
Ki-ette
Kildala
Kinahan
Kingcome
Kitimat
Kitkiata
Kitsalas
Kitselas
Kitsumgallum
Klemtu
Kloiya
Knapp
Koya
Kunghit
Kuper
Kwinitsa
Kyeet
Lake
Lakelse
Langara
Laurier
Lelu
Lewis
Lewis
Lima
Long
Loretta
Louis
Louis
McKay
McLaughlin
McLoughlin
Maitland
Maple
Marina
Martini
Mary
Mary
Maurelle
Mayes
Mayor
Melville
Metford
Metlakatla
Miller
Minette
Miskatla
Mission
Money
Moody
Moore
Morice
Moricetown
Morrice.
Morricetown
Morse
Mouat
Na-a-ma
Nadina
Nahlin
Nalta
Nankivell
Nasoga
Nechako

BRITISH COLUMBIA—*Continued.*

Coast—*Con.*

Nelly
Nemaia
Nesto
Nicholas
Nicolas
Niut
Noel
Noolki
North
North Porpoise
North Skeena
Nowell
Nubble
Nulki
Okisollo
Oldfield
Ootsa
Osborn
Owen
Oxstall
Paisley
Parizeau
Pender
Pepin
Pethick
Phelan
Philips
Photograph
Pillsbury
Pilot
Porpoise
Port Essington
Prevost
Prince Rupert
Promise
Pulteney
Pulton
Quadacha
Quadra
Quaneca
Quinitsa
Raley
Raymond
Ridley
Riordon
Ritchie
Roberson
Round
Russell
Salvus
Schreiber
Scott
Seal
Shames
Sharbau
Shawatlan
Shoo-wah-tlans
Simpson
Siwiti
Skaloo
Skeena
Skelu
Skena
Skidegate
Snider
Sockeye
Sonora
Southgate
South Porpoise
Spire
Springer
Square
Squire
Stainforth
Staniforth
Stapledon
Stelako
Stella
Stellako
Stevens
Stewart
Stickelahn
Stikelan
Stuart
Surge
Tachick
Tarte
Tatla
Tatlahco
Tatlayako
Tatlayoco
Tatlayoko
Tatlayoo
Telkwa
Tiahn
Tian
Tide
Tobey
Tomkinson
Tomlinson
Tremayne
Trivet
Tuck
Tullin
Turn
Turtle
Tyee
Ursula
Valdes
Venn
Verney
Vigilant
Waiatt
Wainwright
Walbran
Walkem
Walkem
Walters
Wark
Watson
Wedge
Wi-yat
Wolfe
Work
Wright
Wyatt
Zanardi
Zemawdza
Zymoetz

Kamloops.

Adams
Ancsty
Angle
Anstey
Bastion
Chipooin
Chipuin
Connaught
Coutlee
Fraser
George
Gold
Gorge
Griffin
Hunters
Ida
Joss
Little Shuswap
Mabel
Mara
Monté
Murtle
Myrtle
Nicoamen
Nicola
Nisconlith
Niskainlith
Niskonlith
Nohomin
Paul
Reservation
Salmon
Salmon Arm
Seymour
Shoushwap
Shuswap
S. Thompson
Spallumcheen
Toonkwa
Tunkwa
Upper Nicola

Kootenay.

Abbot
Abbott
Adamant
Afton
Airy
Akamina
Akamina
Akolkolex
Akotkolex
Albert
Alexander
Alexandra
Amiskwi
Angle Peak
Ann
Anstey
Argentine
Argonaut
Argyle
Arrowpark
Assiniboine
Asulkan
Athalmer
Augustine
Austerity
Avalanche
Ayesha
Azimuth
Bad
Bagheera
Bain
Baker
Bald
Baldur
Balfour
Bannock
Battle
Beatrice
Beaver
Beaverfoot
Beavertail
Bedlington

BRITISH COLUMBIA—*Continued.*

Kootenay—*Con.*

Begbie
Biddle
Blackfriars
Blackwater
Blaeberry
Blueberry
Blue Grouse
Bonney
Booth
Bor
Bosworth
Boulder
Boundary
Bow
Bowman
Brewery
Brewster
Brisco
Broadwood
Bruins
Bryce
Bull
Burgess
Burton
Bush
Butwell
Cabin
Cahill
Calder
Campbell
Canterbury
Cape Horn
Caribou
Caribou
Carroll
Cartier
Carnarvon
Cascade
Castor and Pollux
Catamount
Cataract
Cathedral
Caven
Centurion
Chancellor
Chaperon
Cheops
Cherub
Christy
Cinnamon
Citadel
Clachnacudainn
Clarke
Coal
Cogle
Collie
Collie
Columbia
Cony
Copeland
Coral
Corbin
Cornice
Corsair
Cougar
Couldrey
Cranberry
Cranbrook
Creston
Crowsnest
Cupola
Curtis
Cyprian
Dago
Dainard
Daly
Dawson
Deer Park
Deltaform
Demers
Dennis
Dent
Denver
Despatch
Desolation
Deville
Dibble
Dispatch
Dogtooth
Donkin
Duchesnay
Duncan
Eagle
Earl Grey
Elk
Emerald
Emerald
Ennis
Erickson
Esplanade
Evans
Falls
Felucca
Feuz
Ferguson
Fernie
Field
Fife
Fire
Fish
Fisher
Flat
Flathead
Fleming
Float
Fording
Fort Steele
Fosthall
Four-mile
Fox
Freda
Freshfield
Freya
Frigate
Fritz
Galbraith
Galena
Galton
Garnet
Gateway
Geikie
Gibraltar
Gimli
Glacier
Glacier Crest
Gladsheim
Gladstone
Glenogle
Gnat
Goat-Canyon creek
Goatfell
Gold
Goldstream
Goodsir
Gordon
Gothics
Grace
Graham
Grand
Granite
Grant
Grave
Grays
Gray Wolf
Green
Greens
Greys
Grizzly
Grundy
Guardsman
Habel
Halcyon
Hall
Hammond
Hanbury
Hansen
Harmer
Harvey
Haskins
Häsler
Hawkins
Haygarth
Heart
Hector
Heimdal
Hela
Helmet
Hermit
Hidden
Hilda
Hoder
Hogg
Holway
Hoodoo
Hooker
Horn
Horn
Hosmer
Hospital
House
Howell
Howse
Huber
Hughes
Hungabee
Hungry
Hunter
Hurd
Hutchison
Ice
Illecillewaet
Incomappleux
Iconoclast
Ingersoll
Inonoaklin
Invermere
Insulated
Irishman
Iron
Isolated
Johnston
Jordan
Joseph
Kate
Kauffman
Kerr
Kicking Horse
Kid
Kikomun
Killarney

BRITISH COLUMBIA—*Continued.*

Kootenay—*Con.*

Kilpatrick
Kinbasket
King
Kingsgate
Kishinena
Kitamin
Kitchener
Kiwetinok
Kokamun
Koos-ka-nax
Kootenay
Kuskanax
Kuskonook
Ladybird
LaFrance
Lakit
Lamb
Lardeau
Lardo
Laussedat
Lazy
Leach
Leanchoil
Leda
Lefroy
Leon
Leon Hot Springs
Lewis
Lily
Linda
Line
Linklater
Linkwater
Little
Little Slocan
Lizard
Lladnor
Lodgepole
Lonely
Lone Tree
Lookout
Loop
Lower Arrow
Luke
Lussier
Lyell
Macdonald
Mackenzie
Macpherson
Macoun
McArthur
McBain
McCormick
McDonald
McDougal
McEvoy
McGregor
McMullen
McNicoll
Manganeso
Marion
Mark
Marpole
Marten
Martins
Matthew
Maus
Meacham
Meadow
Mescoh
Michael
Michaud
Michel
Middle Fork, Gold Cr.
Minaret
Mineral
Misko
Mista
Mitchell
Moberly
Moloch
Monroe
Mooyie
Morrissey
Mosquito
Mouse
Moyie
Mud
Mud
Mulvey
Mummery
Nakimu
Nakusp
Naumulten
Nelson
Nemo
Neptuak
Niles
Niord
Norbury
Norns
North Albert
North Branch of Kicking Horse R.
North Fork
North Fork, Michel Cr.
North Fork, Yoho R.
North Kootenay
North Star
Novelist
Octopus
Odaray
Odin
Oesa
Ogden
Ogre
O'Hara
Oke
Oliver
Otterhead
Ottertail
Owen
Paget
Palisade
Palliser
Palmer
Palmer Bar
Park
Pearce
Peavine
Perley Rock
Perry
Phillipps
Pilkington
Pilot
Pingston
Pinnacle
Pirate
Pitt
Plumbob
Pollinger
Popes
Porcupine
President
Privateer
Procter
Pudding
Purity
Pyramid
Rainy
Ravelin
Redan
Redburn
Redding
Reserve
Revelstoke
Ridgeway
Rinda
Ripple
Robertson
Robson
Rock
Rogers
Rose
Ross
Ruby
Russel
Rykerts
St. Eugene
St. Mary
Sand
Sanderson
Sanderson
Sangrida
Sapphire
Sarbach
Saugum
Sawyer
Scalping Knife
Schaffer
Sealion
Selkirk
Selwyn
Seraph
Sharp
Shaughnessy
Sherbrooke
Shields
Sifton
Silvertip
Simpson
Sir Donald
Sir Sandford
Six-mile
Skirmish
Slocan
Smart
Snowslide
Sodalite
Solitude
Sonata
Sophia
Sorcerer
S. Br. or Fork, Michel Cr.
S. Fork, Gold Cr.
S. Fork, Grave Cr.
Spike
Spillimacheen
Spirit
Sproat
Stanford
Stanley
Starvation
Steele
Steep
Stephen
Stevens
Stockmer
Storm
Sugarloaf

BRITISH COLUMBIA—*Continued.*

Kootenay—*Con.*

Sullivan
Sunshine
Swan
Swanzy
Swiss
Syringa
Tabernacle
Tackle
Takakkaw
Tallon
Tent
Terminal
The Bishops
The Dome
The Monarch
The Needles
The Overlook
The President
The Rampart
The Stragglers
The Steeples
The Vice President
Thor
Thumb
Tilley
Toby
Tokumm
Tonkawatla
Topham
Torrent
Tower
Tracy
Trident
Trolltinder
Truda
Tulip
Tupper
Turret
Twenty-five mile (Cr.)
Twin
Two-bit
Upper Arrow
Upper Emerald
Upper Kootanie
Urd
Ursus Major
Ursus Minor
Uto
Valhalla
Valkyr
Van Hooven
Van Horne
Van Houten
Vaux
Ventego
Vertebrae
Vertical
Victoria
Vidette
Vingolf
Waitabit
Walker
Wallenger
Wapateehk
Wapta
Wapta
Waputik
Wardner
Washmawapta
Waterfall
Weaver
Wedgwood
Wenkchemna
W. Arch, Gold R.
W. Fork, Bull R.
Whaleback
Whatshan
Wheeler
Whitefish
White Grouse
White Man
Whymper
Wild Horse
Wigwam
Willowbank
Wilson
Windermere
Wiwaxy
Woden
Worthington
Wotan
Yahk
Yarrell
Yoho
Yukness
Zinc

Lillooet.

Anderson
Birkenhead
Brew
Bridge
Cadwallader
Cayoose
Cayoosh
Chilco
Chilcote
Chilcotin
Chilko
Currie
Duffy
Fergusson
Fraser
Gun
Gunn
Hanceville
Lillooet
McGillivray
McGillvary
McLean
Marble
Mission
Na-a-ma
Nemaia
Pemberton
Penrose
Pool
Poole
Riske
Scaton
Seton
Sheba
Shulaps
Taseco
Taseko
Tatlow
Tyaughton
Whitewater
Yalakom

New Westminster.

Active
Ballenas
Ballinac
Blanchard
Blanshard
Boundary
Brackendale
Buntzen
Burrill
Cain
Campbell
Cheakamus
Chilliwack
Collenson
Cultus
Daisy
Descanso
Discovery
Duke
Fraser
Galiano
Georgia
Green
Houston
Houstoun
Huntingdon
Knight
Kuper
Lasketti
Lasquely
Lasqueti
Malaspina's
Matthews
Mayne
Miles
Mouat
Mouatt
Parson
Pender
Plumper
Plumper's
Porlier
Portier
Prevost
Rip
Rocky
Rosenfeld
Ruth
Schooner
Seechelt
Semiamu
Squamish
Sumas
Sumass
Swehl-tcha
Tahtaloo
Tamihi
The Golden Ears
Tinson
Trout
Tummehai
Valdes
Vananda
Vedder
Whaler

Osoyoos.

Bobbie Burns
Deep creek
Gold
Kettle
Mabel
Shoushwap
Shuswap
Spallumcheen
Trepanage
Trepanier

BRITISH COLUMBIA—*Continued.*

Similkameen.

Arlington
Ashnola
Beaver
Beaverdell
Boundary
Carmi
Carson
Cascade
China
Crystal
E. Fork of W. Fork Kettle R.
Ferroux
Grand Forks
Hall
Hardy
Kettle
King Solomon
Midway
Mosher
Osoyoos
St. John
Similkameen
Sophia
S. Fork of Beaver (creek)
S. Similkameen
Trapper
Wallace
Wilkinson

Yale.

Britton
Chilliwack
Coquihalla
Eagle
Fish
Fraser
Granite Creek
Grasshopper
Henning
Hozameen
Jackson
Klesilkwa
Kwoiek
Loadstone
Lodestone
Murphy
Nepopekum
Nohomin
Olivine
Paradise
Pasayten
Quartet
Quoieek
Rabbitt
Riddell
Roach
Roche
Shawatum
Silver
Similkameen
Skagit
S. Similkameen
Spearing
Steamboat
Sumallo
Tulameen
Uztlius
Whipsaw

Vancouver Island.

Admiral
Albert Edward
Anderson
Arbutus
Arnet
Arrowsmith
Bamfield
Banfield
Barclay
Barkley
Baynes
Bazan
Becher
Beck
Beddingfield
Beecher
Beechy
Beeghados
Belcher
Benson
Bentinck
Big Saanich
Blinkhorn
Bluff
Booth
Boulder
Brabant
Braden
Brandon
Brenton
Broom
Brotchie
Bruce
Buck
Burgoyne
Burial
Burveith
Cassidy
Cattle
Chase
Chase River Crossing
Chemainus
Chemainus
Cherry
Chilliwack
Chuan
Church
Clayoquot
Clayoquet
Cluster
Coal
Cobble Hill
Coffin
Colborne
Colbourne
Colburne
Collins
Commerell
Commerell
Conspicuous
Conuma
Cordova
Cordova
Cormorant
Coronation
Cottle
Cowichan
Cowichan
Cowichin
Cowitchin
Crown
Dayman
Deadman
De Courcy
Demaniel
Departure
Dodd
Donaldson
Double
Douglas
Douglas
Duffin
Duncan
Dunsmuir
Edgell
Edmund
Effingham
Empress
Entrance
Erskine
Execution
Extension
Fairway
False
Felice
Finlayson
Fleet
Francis
Fraser
Frazer
Fuller
Gabriola
Galiano
Gallows
Garibaldi
Georgia
Glacier
Goldstream
Gonzales
Grice
Guaquina
Hall
Halsted
Hammond
Haslam
Hayes
Hecate
Henderson
Hoggan
Holden
Holland
Horse Shoe
Horswell
Howe
Hudson
Icarus
Imperieuse
Inner
Jack
Jack's
Jeffrey
Jesse
Joan
Jocelyn
Jordan
Karmutsen
Kirby
Kla-anch
Koksilah
Kulleet
Ladysmith
Lagoon

BRITISH COLUMBIA—*Concluded.*

Vancouver Island—*Con.*

Langford
Leading peak
Leboeuf
Leech
Lighthouse
Link
Lock
Long
McDonald
McKay
McLaughlin
McLoughlin
Maguire
Malahat
Maple
Matheson
Maxwell
Metchosin
Michael
Moresby
Mouat
Mouatt
Muchalat
Mudge
Muir
Nanaimo
Nankivell
Nares
Narrow
Neck
Neilson
Nigei
Nimpkish
Nixon
North peak
Northumberland
Norway
Opitsat
Osborn
Otter
Oyster
Pachena
Page
Parkins
Parry
Pedder
Pender
Pender
Piers
Pilot
Pimbury
Pinbury
Point-no-point
Portland
Possession
Prevost
Protection
Quadra
Quamichan
Race
Ragged
Ranch
Redflag
Reid
Retreat
Richard
Richards
Round
Royal
Saanich
Saanichton
Saddle
Saddle
St. Mary
St. Patrick's
Saltspring
San Josef
San Juan
San Miguel
Sansum
Satellite
Secretary
Secretary
Separation
Shaft
Sharp
Shawnigan
Shepherd
Sheringham
Sherringham
Shotbolts
Shute
Sibell
Sidney
Skinner
Skirt
Snake
Somass
Somenos
Sooke
South Wellington
Spring
Squally
Stockham
Stone
Stuart
Sumass
Survey
Sutil
Swanson
Sydney
Thetis
Tod
Towincut
Trap
Tofino
Trincomali
Trois Bras
Tugwell
Twin
Tyne
Tzuhalem
Union
Usatzes
Vernon
Vesuvius
Victor
Victoria
Wallace
Wallis
Wark
Waugh
Westholme
Whiffen
Whymper
William
Wilson
Wilson's Crossing
Wood
Woods
Woodley
Work
Yellow
Zachariah
Zero

MINING DIVISIONS IN BRITISH COLUMBIA.

Ainsworth
Alberni
Arrow Lake
Ashcroft
Atlin
Bella Coola
Cariboo
Clayoquot
Clinton
Golden
Grand Forks
Greenwood
Kamloops
Lardeau
Liard
Lillooet
Nanaimo
Nelson
New Westminster
Nicola
Omineca
Osoyoos
Peace River
Portland Canal
Quatsino
Queen Charlotte
Quesnel
Revelstoke
Similkameen
Skeena
Slocan
Slocan City
Steele
Stikine
Trail
Trout Lake
Vancouver
Vernon
Victoria
Windermere
Yale

MANITOBA.

Albert
Alexander
Anderson
Antler
Apeganau
Apussigamasi
Armit
Armitt
Asham
Asippitti
Athapapuskow
Atic-a-make
Atikameg
Bad Throat
Bald Eagle
Basquia
Bear
Beaver-dam
Bélanger
Berens
Big
Big Black
Big Cutarm
Big Reed
Birch
Bird
Birds Hill
Birdtail
Birtle
Black
Black
Bloodvein
Blue Hills of Brandon
Bowsman
Boyne
Brandon
Brereton
Brokenhead
Brokenmouth
Burntwood
Burton
Cedar
Childs
Churchill
Claude
Clear Water
Cold
Coleman
Contact
Cormorant
Cowan
Cranberry
Crane
Cross
Cutarm
Cypress
Dauphin
Dawson
Deer
Deer
Doghead
Dog's Head
Dolomite
Drifting
Drumming
Duck
Duck
Duck River N.
Duck River S.
Dunsekikan
East
East Doghead
Ebb-and-Flow
Echimamish
Elbow
English
Fairford
File
Fisher
Footprint
Fork
Gainsborough
Gods
Graham
Grand
Grauville
Grass
Grass
Great Black
Grenville
Grindstone
Hayes
Hay's
Headingley
Hecla
Herb
High Bluff
Hill
Hill
Hole
Hudson
Huns Valley
Icelandic
Iles de Bois
Indian
Indian Pear Island (lake).
Island
Ithenotosquan
Jackhead
Jackson
James Ross
Kematch
Kiskitto
Kiskittogisu
Kisseynew
Kississing
Kiwanzi
Landing
LaRivière
Laurie
Lawrence
Le Pas
Lilly
Limestone
Little Black
Little Saskatchewan
Lobstick
Long
Loonhead
Lorette
Lorne
Louise
McCreary
Manasan
Manigotagan
Manitoba
Mantagao
Manuminan
Maskwa
Matheson
Methy
Minago
Minitonas
Minnewakan
Missinnippi
Missipisew
Mitishto
Moose
Moosehorn
Morris
Mossy
Mountain
Muddy Water
Muhigan
Munosahn
Muskrat
Nelson
Netley
Net Setting
Nipuwin
Niskitogisew
Nistowasis
Norris
North Antler
North Duck
N.W. Angle
Oak
Oakbank
Odei
Oiseau
Omatuwi
Onatamini
Ooskootim
Opegano
Ospwagan
Outer Sturgeon
Overflowing
Paint
Pakwa
Pakwahigan
Paquehigan
Partridge Crop
Pas
Pasquia
Payoonan
Pembina
Pentemerus
Peonan
Pine
Pineimuta
Pineroot
Pipe
Pipestone
Pipestone
Plum
Point
Pokkattawagan
Poplar Point
Portage
Portage-la-Prairie
Pruden
Puke-lowogein
Pukkattawagan
Punk
Punk
Qu'Appelle
Rapid
Rat Portage (lake)
Reader
Reed
Reeder
Reindeer
Richard
Riding
Roaring
Rolling
Roseau
Ross
Sagemace

MANITOBA—*Continued.*

Sahpoochaway
St. Andrew
St. David
St. George
St. Martin
St. Patrick
Sandy
Saskatchewan
Saskeram
Scratching
Segatiga
Sepewesk
Setting
Shell
Singoosh
Singush
Sipiwesk
Sisipuk
Slave
Sleeve
Snake
Souris
South Antler
South Duck
Southern Indian
Spence
Split
Squirrel
Steel
Steeprock
Swan
Sweet Herb
Takipy
Teal
The Big (slough)
The Elbow
The Pas
Threepoint
Traverse
Trout
Turnagain
Turtle
Valley
Vankoughnet
Violadale
Wabishkok
Wanipigow
Wapichtigow
Wapishtigau
Warpath
Waskatowaka
Waskaiowaka
Washow
Waskik
Waskiktepigo
Waskwatim
Watchi
Waterhen
Weir
Wekusko
Wepiskow
West
Westbourne
West Dog Head
West Niskitogisew
Whitemouth
Whitemud
Whiteshell
Whitewater
Whiteway
Wilson
Wimapedi
Windy
Winnipegosis
Wintering
Witchai
Wolf
Wolf Rand
Wood
Woody
Wuskatasko
Wuskwatim
Yawningstone

NEW BRUNSWICK.

Albert.

Albert
Baltimore
Beech Hill
Big
Cap de Moselle
Chignecto
Crossman
Demoiselle
Edgett
Enrage
Golden Mountain
Gowland Mountain
Gray
Grey
Hopewell Corner
Irving
Niagara
Petcoudiac
Petitcodiac
Point Wolf
Rougie
Roxburgh
Salisbury

Carleton.

Becaguimec
Beechwood
Bumfrau
Maduxnakeag
Manquart
Mars Hill
Meduxnekeag
Monquart
Munqnart
Newburg
Newburg Junction
Peckagomique
Presquile
Richmond
Richmond Corner
Rivière-des-Chutes
Shictahawk
Shiktahawk

Charlotte.

Belas
Campobello
Campo Bello
Canous
Canouse
Deadman
Etang
Flag, Flag's or Flagg's
Grand Manan
Grand Manan
Harbour de Lute
Kanus
Lepreau
L'Etang
L'Etete
Letite
Loutre
Mace
Mascabin
Mascareen
Mascarin
Mchollan
Meholland
Menan
Midjik
Mijic
Mulholland
North Head
North Road
Paskekegan
Piskahegan
Rollingdam
St. Andrews
St. Stephen
Watt
Watt Junction
Welshpool

Gloucester.

Alemek
Baie des Chaleur
Bartibog
Caraquet
Caron
Carron
Chaleur
Elmtree
Flemming
Grande Anse
Green Point
Lamek
Laplante
Limestone
Little Nipisiguit
Millstream
Miltonbrae
Miscou
Mya
Mya
Nepisiguit
Nickadow
Nigadu
Nipisiguit
Nipisiguit Millstream
North Mya
Petit Rocher
Pockmouche
Pocmouche
Pokemouche
Pokesudi
Shippigan
S. Brch. Little (river)
South Mya

NEW BRUNSWICK—*Continued.*

Gloucester—*Con.*

Tetagouche
Teteagouche
Young's

Kent.

Cocagne
Galloway
Galway
Kingston
Macdougall
Molus
Moulie's
New Galloway
New Galway
Pelerin
Point Sapin
Puellering
Rexton
St. Mary
St. Paul

Kings.

Newtown
Pequaket
Philmonro
Pickwaket
Pikwaket
Quispamsis

Madawaska.

Gounamitz
Gunamitz
Little Fork
Waagan
Wagan

Northumberland.

Barnaby
Cain
Cain River
Kains
Mamozekel
Miramichi
Mirimichi
Momozekel
Nepisiguit
Nipisiguit
Rivière-des-Caches
Rogersville
Stratharbo
Tabasintac
Tabisintac
Tabusintac

Queens.

Gaspereau
Grimross
Washademoak
Washedemoak

Restigouche.

Baie des Chaleur
Campbellton
Chaleur
Cold Brook
Colebrooke
Dawsonvale
Dawsonville
Gounamitz
Gunamitz
Kedgwick
La Lime
Lanim
Le Nim
Little Fork
Little Tobique
Nictor
Quatawamkedgewick
Restigouche
Ristigouche

St. John.

Courtenay
Lorneville
McCoy
Manawagonish
Martin
Maspeck
Michepasque
Mispec
Mispeck
Mispek
Misshapec
Mizpeck
Pisarinco
Quaco
Quaco
St. Martin
St. Martins
Thompson

Sunbury.

Gaspereau
Oromocto
Oronocto
Portobello
Rusagonis
Rushagornis

Victoria.

Aroostook
Arthuret
Campbell
Ennishone
Ennishore
Gounamitz
Gulquac
Gunamitz
Little Fork
Little Tobique
Mamozekel
Momozekel
Nictau
Odellach
Otellock
Rapide-de-Femme
Right Hand Brch Tobique R.
Riley
Sisson
Tobique
Tobique
Trousers
W. Brch. Tobique R.

Westmorland.

Aboushagan
Aulac
Baie-Verte
Bay Verte
Belliveau
Berrys Mills
Boyd
Bristol
Chignecto
Folly
Fort Folly
Gaspereau
Gaudet
Great Shemogue
Grindstone
Jolicœur
Léger
Légere Corner
Lutz
Missaguash
Misseguash
Missiguash
Missiquash
Oulac
Painsec
Petcoudiac
Petitcodiac
Point de Bute
Pont-à-Buot
Shemogue
Sunny Brae

York.

Becaguimec
Brockway
Brookway
Chiputneticook
Coac
Koak
McAdam
Nacawicac
Nackawic
Newmarket
Oromocto
Oronocto
Peckagomique
Pocowagamis
Pokiok
Pokowagamis
Poquiock
Sheogomoc
Shogomoc
Springfield
Springhill
Stanley
Stanley Village
Taxes
Taxis
Taxous
Texas

NOVA SCOTIA.

Annapolis.

Cegemecega
Chute
Delap Cove
Kejimkujik
Margaretville
Marshall Cove
Port Lorne
Port William
Segum Sega

Antigonish.

George
Harbour au Bouche
Havre Bouché
St. George

Cape Breton.

Big Loran
Big Lorraine
Bras d'Or
Clark
Cow
Cow Bay (village)
Flat
Fourchu
Gabarus
Gabarouse
Great Bras d'Or
Great Bras d'Or (lake)
Little Bras d'Or
Little Loran
Little Lorembec
Little Lorraine
Lorembec
Low
Low
Mainadieu
Menadou
Morien
Morien Bay (village)
Margin
Neal
Neil
Peter's
Petre
Petrie
Petrie's
Port Morien
St. Andrew
Scatari
Winging
Wining
Winning

Colchester.

Basin of Mines
Debert
Debert
Kemptown
Masstown
Minas basin
Mines basin.
Partipique
Portapique
Waughs

Cumberland.

Basin of Mines
Chignecto
Chinimicash
Conn Mills
D'Or
Dore
Joggins
Macan
Maccan
Minas basin
Mines basin
Parrsboro
Philip
Phillip
Salem
Salent
Shinimikas
Shoulie
Shulie
South Joggins
South Joggings

Digby.

Bear
Belliveau
Brier
Bryer
Hebert
Metaghan
Meteghan
Meteghan Station
Prim
Rogers
St. Mary

Guysborough.

Caledonia
Charlo
Charlo's Cove
Country
Crow Harbour
Green
Isaac Harbour
Liscomb
Middle Caledonia
Newton
Newtown
Port Bickerton
Queensport
Sherbrooke

Halifax.

Barrie
Big Thrumcap
Black Duck Run
Boutilier
Boutillier
Brian
Brine
Caribou Mines
Catch
Clarke
Cleaveland
Cleveland
Coachman
Coolen
Coonan
Covey
Coyle
Dauphinee
Dauphney
Dover
Doyle
Eisner
Eisenhaur
Fleming
Frederick
Frostfish
George
Grampus
Grand
Hackett Cove
Haggert
Harbour
Hosier
Hubbards
Hubley
Hubly
Isnor
Ketch
Kieley
Kitiwiti
Leary
Lichfield
Litchfield
Little Musquodoboit
Little R. Musquodoboit
Mauger
Meagher
Mosher
Myra
Navy
Oakland
Osier
Peggy Cove
Perpisawick
Perrang
Perrin
Petpeswick
Pine Wood
Ponhook
Reed
Reid
St. Croix
St. Margaret
Schnare
Shad
Shag
Sheehan
Shehea
Shubenacadie
Slaughenwhite
Smith
Snares
Stephens
Stevens
Stony
Tangier
Taylor
Tenants
Terence
Tern
Thom
Thrumcap
Tom
Tun
Turner
White
Wynott

NOVA SCOTIA—*Concluded.*

Hants.

Basin of Mines
Cheverie
Chiverie
Cockmagun
Cockmigun
Cogmagun
Grand
Hennigar
Joshua Hennigar
La Tete
Minas basin
Mines basin
Northfield
Petite
Ponhook
St. Croix
St. Croix
Shubenacadie
Tenecape
Tenny
Tennycape
Teny
Tenycape
Threemile Plains
Walton
Weir

Inverness.

Balache
Belache
Belhache
Bras d'Or
Cheticamp
Dennis
Denys
Grand-Etang
Great Bras d'Or (lake)
Henry
McMillan
Margaree
Outer
Outer I. of Port Hood
Plaster Cove (pt.)
Port Hood
Port Hood Island (P.O.)
River Denys
St. Patrick
Smith's
W. D. Smith's

Kings.

Basin of Mines
Baxter Harbour
Billtown
Canaan
Chipman Corner
Coldbrook
Hall
Hall Harbour
Indian
Kinsman
Longspell
Meehin
Minas basin
Mines basin
New Canaan
North Corner
Norths
Scotsman
Sheffield Vault
Split
Wheaton Vault
Whiterock
White Rock Mills
Whites
White's Corner

Lunenburg.

Aspatagoen
Aspotogan
Coleman
Dares
Dauphinee
Dauphney
Gaetz
Green
Hobson
Indian
Lahave
Le Havre
Meisner
Misener
Pearl
Upper Lahave

Pictou.

Barney
Barney River
Big
East
John
Merigomish
Middle
West
West river of Pictou

Queens.

Cegemecega
Fairy
Joli Head
Kejimkujik
Medway
Port Joli
Port Matoon
Port Medway
Port Metway
Port Mouton
Segum Sega

Richmond.

Ardoise
Bras d'Or
Creighton
Crichton
D'Escousse
Discousse
Dog
Framboise
Freestone
George
Gooseberry
Great Bras d'Or (lake)
Green
Gregory
Habitants
Inhabitants
Janvrin
Jauvrin
L'Ardoise
La Ronde
Marjorie
Petitdegrat
Petit Degrat
Petit de Grat
Poulamon
Rond
Round
St. George
Seal

Shelburne.

Barrington
Barrington Passage
Big Port l'Hebert
Cape Negro (island)
Cape Negro Island (P.O.)
Emulous
Emulow
Head of Jordan (river)
Jordan River
Locke
Lockeport
McNutt
Negro
Negro
Port Ebert
Port Hebert
Port L'Hebert
Port Latour
Ragged
Ragged Island (harbour)
Rugged
Rugged Island (harbour)
Shelburne
Shelburne Harbour
West Passage

Victoria.

Aspy
Bird
Boularderie
Bras d'Or
Ciboux
Great Bras d'Or
Great Gras d'Or (lake)
Hiboux
Indian
Inganish
Ingonish
Munro
Niganishe
St. Andrew
St. Ann
St. Patrick

Yarmouth.

Cegoggin
Chagoggin
Chegoggin
Great Tusket
Green Cove
Maitland
Port Maitland
Tusket
Tusket Wedge
Wedgeport

ONTARIO.

Addington.

Ashby
Effingham
Island
Little Weslemcoon
Weslemkoon

Algoma (district).

Bachewanaung
Bagutchuan
Batchawana
Blind
Bridgland
Brulé
Chiblow
Chippewa
Clear
Coldwater
Corbay
Corbeil
E. Branch Thessalon R.
Endikai
Grand
Grasett
Harmony
Hilton
Jackson
Jones
Kaikaquabick
Kenogami
Macoming
Madendanadu
Magog
Marksville
Matinativdo
Misinabi
Missanabie
Missinaibi
Mississagi
North Lizard
Pagwachuan
Pakowagaming
Pakowcaming
Pakowkami
Parisian
Parisienne
Patauquin
Pawghtchewan
Pawgutchewan
Pegamasai
Petauguin
Pougulchuan
Reception
Robertson
Rowe
St. Mary
Shookum
Skookum
Superior
Tendinenda
Waagoosh
Wahbiquckobing
Wahcomatagaming
Wahquekobing
Wakomata
Wakwekobi
Waugush

Brant.

Alford
Alford Junction
Eaglenest
Middleport
Mohawk
Mt. Pleasant
Nith (river)
Smith's (creek)
Tuscarora
East
Gage
Knapp
Long
Melville
Myles
Ninemile
Penitentiary
Prince Regent
Quebec
Royal George
Seven Acre
Wolfe

Bruce.

Arbutus
Argyle
Bad Neighbour
Baptist
Barrett
Beament
Belcher
Birch
Boyer
Burke
Campbell
Cataract
Cavalier
Chantry
Chiefs
China
Cigar
Clark
Corisande
Cornet
Corsair
Cove
Cove Island
Crab
Dack
Dane
Doctor
Dorcas
Doré
Douglas
Eagle
Earl Patches
Echo
Evelyn
Fishing
Flowerpot
Gat
Gauley
Ghegheto
Gig
Gilphie
Georgian
Golden
Greenfield
Greenough
Gull
Gunn
Harmony
Hopkins
Horton
Huntress
Hurd
Inverhuron
Isle of Cores
Johnston
Juno
Kincardine
Knife
Kolfage
Lambert
Lee
Lionhead
Logie
Loscombe
Lyal
MacGregor
Macpherson
McCallum
McElhinney
McNab
McRae
Mad
Main
Malcolm
Milton
Parker
Penetangore
Pine
Pine Tree
Porcupine
Port Elgin
Ragged
Red
Reid
Ripple
Russel
Saturn
Saugeen
Saxon
Scott
Scougall
Scout
Seashell
Shute
Sibert
Simon
Smokehouse
Snake
Southampton
Stokes
Stony
Tecumseh
Terry
Tobermory
Tolmie
Turning
Twin
Vrooman
Wanderer
Warner
Warren
Wells
Welsh
Wreck
Youell
Zinkan

ONTARIO—*Continued.*

Carleton.

Bells Corners
Britannia Bay
Buckham
Dwyerhill
Rockcliffe
Rockliffe
Goulburn
Hardwood Plains
Harwood Plains
Hemlock
Herbert Corners
Hurdman
Hurdman's Bridge
Jockvale
Johnston Corners
Limebank
Mackay
Orleans
Ottawa
Remic
Remous
St. Joseph d'Orleans
Stanley Corners
Stittville
Westboro
Woodroffe

Dundas.

Bouckhill
Brinston
Brinston's Corners
Dixon Corners
Galop
Little Nation
Nation
Petite Nation
Reid Mills
South Nation
Toussaint
Toussons
Toyehill

Elgin.

Aldborough
Aylmer
Big Otter
Big Otter Creek
Glencolin
Otter
Port Burwell

Essex.

Edgar
Edgar's Mills
Fighting
Ile aux Pêches
Peach
Pelee
Pointe Pelee
Puce
Ruscom
St. Clair
St. Joachim

Frontenac.

Ambella
Arabella
Bayfield
Big
Bolivia
Brown's
Carpenter
Cataraqui
Ferguson
Francis
Frederick
Great Cataraqui
Halliday
Henry
Hickory
Hinckley
Holliday
Levi
Marysville
Mud
Pearson's
Spardan
Wolfe Island (Tp. and vil.)

Glengarry.

Baudet
Beaudet
Black
Bodet
Colquhoun
Craigs
Delisle
Garry
Glenbrook
Glengarry
Glennevis
Glenroy
Grant Corners
L'Islet
Mouile
Mouille
Mouillée
Munroe Mills
Raisin
Rigaud
Riv. aux Raisins
St. Raphael
Stanley
Stonehouse

Grenville.

Acton Corners
Bishop
Bishop's Mills
Burritt Rapids
Easton
Easton's Corners
Galop
Graisse
Kemptville
Little Nation
McReynolds
McReynold's Corners
Millar
Millar's Corners
Nation
Petite Nation
Shanly
South Nation
South Rideau
Wilson
Wilson's Bay

Grey.

Georgian

Haldimand.

Canboro
Cook
De Cewville
McKenzie
Nelles
Nelles' Corners
Sherbrooke
Willowgrove

Haliburton.

Boshkung
Bright
Burnt
Canning
Cay-ke-quah-bekung
Davis
Drag
East
Eel
Eels
Farquart
Fishtail
Fletcher
Grace
Haliburton
Hall's
Harry
Johnson
Kabakwa
Kah-bah-bah-quah
Kah-shah-gah-wig-e-mog
Kah-wah-she-be-mah-gog
Kahwambejewagamog
Kashagawi
Kashagawigamog
Kawagama
Kekkekwabi
Ken-ne-big
Ken-ne-ses
Kennibik
Kennisis
Kimball
Kingscote
Kushog
Little Boshkung
Louisa
Macdonald
McFadden
McKenzie
Miskwabi
Mis-quah-be-nish
Monk
Monmouth
Moore
Ne-na-tik-go
Ninatigo
North
Numnekaming
Nunikani

ONTARIO—*Continued.*

Haliburton—*Con.*

Oxtongue
Paudash
Pee-pee-ke-wah-be-kung
Pen
Percy
Pipikwabi
Poverty
Redstone
Rock
Sah-wah-mish-she
St. Nora
Sawamisshi
Sheldon
Soyers
Stormy
Straggle
Welcome

Halton.

Bronte
Milton
Milton West
Oakville
Sixteen Mile
Snider
Snider's Corners
Twelve Mile

Hastings.

Anne
Baker
Baptiste
Bayside
Boulter
Clark
Coehill
Coe Hill Mines
Copeway
Deseronto
Diamond
Dickey
Dixon
Egan
Fraser
Grimsthorpe
Gunter
Hastings
Hungry
Jamieson
Jamieson's
Jordan
Kaijick Manitou
Kamaniskeg
L'Amable
Limestone
Long
Long
Moira
Myers
Nigger
Ox
Papineau
Quinte
Salmon
Shannonville
Sidney
Snake
Tangamong
Telegraph
Thomson
Thurlow
Trent
Trenton
Trident
Tyendinaga
Wadsworth
Whetstone
Wolf
York
Zwick

Huron.

Albert
Ausable
Bayfield
Blacks
Cantin
Goderich
Kintail
Maitland
Menesatung
Sable
St. Joseph
Wright

Kenora (district).

Abraham
Abram
Adam
Affleck
Aiabewatik
Alexandra
Amik
Ant
Anzhekumming
Armstrong
Ash
Asheigamo
Assinkepatakiso
Atikwa
Austin
Bad Rice
Bailey
Bakado
Ball
Balne
Barclay
Barnston
Barren
Barrie
Basket
Bass
Beaubien
Beaverhouse
Bending
Bent
Berry
Black Bird
Black Sawbill
Blueberry
Botsford
Boulder
Bowden
Boyer
Brownie
Burnet
Burntwood
Butler
Calder
Cameron
Cañon
Canoe
Carleton
Caron
Celtis
Centrefire
Cherry
Circle
Clear
Clearwater
Cleftrock
Cliff
Cook
Corn
Crow
Daniels
Danish
Deacon
Deer
Delany
Denmark
Dinorwic
Discovery
Dominick
Don
Drewry
Dryberry
Dryden
Dyment
Eagle
Eagle Rock
Edith
Edward
Elbow
English
Ethel
Eva
Evening
Favel
Fawcett
Fiord
Fisher
Flint
Fluke
Fog
Foreleg
Forest
Gamskagamik
Gawjewiagwa
Ghost
Gilbert
Gordon
Grassy River (lake)
Grindstone
Gryphon
Hall
Harris
Hawk
Hawkcliff
Hawkrock
Hebden
Hector
Highstone
Hill
Hodgins
Hourglass
Hughes
Hutchison
Ingall
Jay
John
Kabagukski
Kabikwabik

ONTARIO—*Continued.*

Kenora (district)—*Con.*

Kabitustigweiak
Kagiwiosa
Kaiashkomin
Kakagi
Kakinnozhans
Kamanatogama
Kaminnassin
Kaminnaweiskagwok
Kaminni
Kamongus
Kaopskikamak
Kaoskauta
Kapesakosi
Kapikwabikok
Kasakacheweiwak
Kawashegamuk
Kawasheibemagagamak
Kawawia
Kawawiagamak
Keikewabik
Kekekwa
Kennabutch
Kennewapekko
Kenora
Kenozhe
Keys
Kilvert
Kimmewin
Kinnickoneship
Kinnyu
Kinoje
Kiskopkechewans
Knob
Kramer
Kukukahu
Kukukus
Kukus
Large Trout
Laurier
Lester
Lewis
Lindal
Line
Linklater
Little Jackfish
Little Wabigoon
Lobstick
Lonely
Lone Man's
Long
Loon
Lorne
Lost
Lount
Low
Lynx
MacMillan
McDonald
McHugh
McIntyre
McLennan
Mang
Manitou
Manitumeig
Manomin
Mark
Martin
Matilda
Maynard
Meander
Meggisi
Menikwesi
Mennin
Meskwatessi
Mestowana
Miller
Minnaweiskag
Minnehaha
Minnesabik
Minnikau
Minnitaki
Mongus
Moonshine
Morgan
Mountain
Mud
Mystery
Namego
Nemeibennuk
Nimrod
Norse
N. W. Angle
Nozheiatik
Nurse
Oak
Oneman
Ord
Osbourne
Osipasinni
Otakus
Oval
Oxdrift
Painkiller
Parrywood
Peak
Pelican
Penassi
Perault
Percault
Perrault
Pichenninnis
Picture Narrows
Pine
Power
Priam
Rat Portage
Rosamond
Ross
Route
Rowan
Saganaga
Sasakwei
Schist
Schnarr
Seggemak
Selby
Separation
Seul
Shallow
Shingwak
Shongwashu
Silver
Small Trout
Smoothrock
Spar
Stanawan
Stanzhikimi
Stephen
Stewart
Stranger
Sucker
Summit
Summit
Sunday
Sunshine
Syndicate
Taché
Talbot
Tasheigama
Tawatinaw
Teggau
Threefork
Thunder
Tide
Twilight
Unaminnikan
Uphill
Upper Manitou
Vermilion
Vulture
Wabigoon
Wabigwunn
Wall-eye
Walsh
Wapageisi
Wapoose
Wapus
Washeibemaga
Wasp
Weiseieno
Whitney
Wickens
Wigwas
Wilcox
Willard
Williams
Winnange
Woods

Kent.

Dover East
Dover South
East Dover
Ennett
Jeannette
Mitchell
Mitchell Bay
Muirkirk
Paincourt
Rondeau
St. Clair
Turnerville

Lambton.

Blackwell
Blind
Blue
Chematogan
Edward
Eddy's Mills
Edy Mills
Fawn
Harris
Henry Corners
Ipperwash
Kettle
Kingscourt
Mandamin
Moore
Petrolia
Point Edward
St. Anne
St. Clair
Woodtick

ONTARIO—*Continued.*

Lanark.

Allan Mills
Christie Lake
Ferguson Falls
Franktown
Smiths Falls

Leeds.

Adelaide
Admiralty
Amazon
Amherst
Ash
Aspasia
Astounder
Aubrey
Axeman
Bagot
Barge
Bass
Bathing
Bathurst
Battersby
Baumgardt
Beaurivage
Belabourer
Bellamy
Big
Big Stave
Bingham
Black Charlie
Bloodletter
Bloomfield
Bluff
Bluff
Boss Dick
Bouchier
Bowes
Bratt
Bridge
Brock
Broughton
Brush
Bucks
Burnt
Burntstone
Bush
Camelot
Campbell
Carnegie
Catline
Cedar
Champagne
Cherry
Chichester
Chimney
Chimney Island (point)
Citron
Clark
Cleopatra
Club
Cockburn
Collier
Conran
Constance
Cook
Corn
Corn
Corn Island (shoals)
Cunliffe
Cut
Dark
Dark
Dashwood
Davis
Deathdealer
Deer
DeRottenburg
DeWatteville
Dinghy
Dobbs
Doctor
Donald
Downie
Dromedary
Dumfounder
E. Chimney Island (shoals)
Endymion
Everest
Fairfield
Fairfield East
Fairy
Fiddlers Elbow
Fisher
Float
Forsyth
Fort Wallace
Gage
Garden
Garrett
Gates
Georgina
Gibraltar
Gig
Glenelbe
Gordon
Goulbourne
Grape
Grass
Grenadier
Griswold
Grog
Guide
Gunliffe
Hambly
Hamilton
Harvey
Hay
Hickey
Hill
Hog
Hooper
Horseshoe
Howe
Huckleberry
Humbly
Ingall
Jackstraw
Johnson
Jones
Lake Fleet
Leak
Leek
Leroux
Lindoe
Lindsay
Little
Littlejohn
Little Stave
Lynedoch
McCoy
McDonald
McDonald's
McIntosh
McMahon
McNair
Melville
Mermaid
Mile
Mile
Millar's
Milton
Mink
Montgomery
Mulcaster
Murray
Myers
Narrow
Navy
Needles-Eye
Netley
Niagara
Niddery
Ninette
O'Conor
O'Connor
Old Bluff
O'Neil
Otty
Owen
Patterson
Pear
Peel
Perch
Picnic
Pilot
Pine
Pitchpine
Poole
Pooles Resort
Popham
Prince Alfred
Prince Edward
Prince Regent
Princess Charlotte
Psyche
Quarry
Raft
Ramsden
Raspberry
Rattlesnake
Redhorse
Reed
Refugee
Renny
Riall
Rich
Robert
Robinson
Rocksprings
Rolleston
Rose
Rough
Round
Rowley
Royal
St. Helena
St. Lawrence
Savage
Scorpion
Seeley
Seven Pines
Shantee
Shanty
Sheaffe
Sherbrooke
Sherwood Spring
Shoe
Shoemaker
Simcoe

ONTARIO—*Continued.*

Leeds—*Con.*

Sir William
Sisters
Skelton
Smith's
Smoke
Snake
Sparrow
Spectacles
Spilsbury
Spit
Spong
Squaw
Stave
Stovin
Sugar
Sumac
Sumach
Surveyor
Tar
Tent
Tent Island (shoal)
The Punts
Thwartway
Tidds
Tronghton
Twin Sisters
Van Buren
Vansittart
Victoria
Wallace
Watch
Wedlock
Willoughby
Wiltse
Yeo
Yorke

Lennox.

Salmon
Unger

Lincoln.

Bismarck
Camden
Campden
Gainsborough
Grassey's Corners
Grassie
Jordan Harbour
Queenston
St. Ann
St. Catharines
St. David
Wellandport

Manitoulin (district).

Advance
Agawa
Aguawa
Ainslie
Bain
Beech
Bélanger
Benson
Birch
Black
Blake
Blue Jay
Boom
Buckeye
Buller
Burnt
Burnt Island
Cariboo
Carroll Wood
Carter
Castilian
Channel
Charlton
Chisholm
Christina
Cinder
Cockburn
Dave
Dean
Desert
Dominion
Dunn
East Belanger
East Sister
Edna
Ella
Emily Maxwell
Everett
Fagan
False Detour
Fisher
Fitzwilliam
Frechette
Froude
Gaspesia
Gatacre
Genesta
Girouard
Glycerine
Goose
Grand Manitoulin
Grantham
Grant
Gravel
Great Duck
Green
Greene
Greene Island
Gull
Hammond
Hannah
Hensley
Herschell
Hewson
Horseshoe
Houston
Hughson
Hungerford
Husten
Hyndman
Indian
Inkster
Inner Duck
Ivan
Jackson
James
Jenkins
Jennie Graham
Jones
Kipling
Kitchener
Kitty
Labrador
Larry
Leask
Little
Little Cockburn
Little Grant
Little Green
Lonely
Longheed
Lucas
Lynn
Macauley
McCarthy
McGaw
McKay
McKim
McLelan
Magnetic
Maiden
Manitoba
Manitou
Manitoulin
Manitoulin gulf
Manitowaning
Mary
Mayflower
Meldrum
Melville
Methuen
Michael
Middle Duck
Mildram
Mildrum
Milton
Mindemoya
Mink
Misery
Mississagi
Monell
Murphy
Mutchmore
North
Outer Duck
Owen
Pearson
Perseverance
Phœbe
Porphyry
Portage
Providence
Pulpwood
Purvis
Quarry
Queen
Rathbun
Red Dan
Rickett
Rickley
Rixon
Roberts
Robertson
Rudyard
Sand
Saunders
Scotchie
Seaman
Shamrock
Shecake
Ship
Simcoe
Simms
Sims
Smith
South
S. Baymouth
Square
Srigley
Stafford
Steevens

ONTARIO—*Continued.*

Manitoulin (dist.)—*Con.*

Stewart
Stony
Taylor
The Narrows
The Ridge
Thibault
Thistle
Thomas
Timber
Todman
Vigilant
Volunteer
Wagosh
Walker
Walkhouse
Wallace
West Belanger
West Duck
Western Duck
West Sister
Wheeler
White
Wild
Woods
Yeo

Middlesex.

Arva
Fairfield
Glenwillow
Hutchison
Kerwood
London Junction
McGillivray
McInnes
McInness
Maplegrove
Medway
Parkhill
Pottersburg
The Grove
Walker
W. McGillivray

Muskoka (district).

Bays
Brébeuf
Georgian
Leg
Muldrew
Muskoka
Rice
St. Mary
Trading

Nipissing (district).

Aylen
Cache
Camp
Cassels
Dotty
Friday
Great Opeongo
Hay
Link
Little Madawaska
Little Opeongo
Lobster
Macauley
McNevin
Maggie
Matabeehawan
Matabitchuan
Net
Obashkong
Opeongo
Peeshabo
Pishabo
Provoking
Ragged
Rib
Sea
Smoke
Source
Tamagaming
Tasso
Tea
Temagami
Temiscaming
Temiscamingue
Temiskaming
Timagami
Timiskaming
Two Rivers (lake)
White Bear

Norfolk.

Fairground
Kinglake
La Salette
Long
Long Point
Mabee
Maybee
North Foreland
Outer bay of Long Pt.
Villanova

Northumberland.

Brighton
Calf Pasture
Carrying Place
Gale
Murray
Peter
Presqu'ile
Sherwood
Shoal
Stony
Stoney
Trent
Twelve O'clock
Weese

Ontario.

Big Rouge Creek
Couchiching
Champlain
Chiefs
Duffin
Frenchman
Orchard
Pickering
Rouge
Starvation
Strawberry

Oxford.

Banner
Currie
Curries Crossing
Folden
Folden's Corners
Goble
Harrington
Harrington West
Hawtrey
Nith river
Smith's creek
Tillsonburg

Parry Sound (district).

Alwin
Bigsby
Bray
Cherry
Counts
Dead
Depot
Dokis
Frances Smith
Franklin
Georgian
Germain
Guano
Hanna
Keefer
Key
Lash
Maganatawan
Magnetawan
Maun
Murray
Perkins
Phillips
Pine
Pratt
Ruel
Shawanaga
Shebeshekong
Supply
Wedge
Wicksteed

Patricia (district).

Achigo
Anamebini
Annimwash
Asheweig
Attawapiskat
Badesdawa
Bamaji
Bamajigma
Birch
Black Iron
Blackstone
Bluffy
Cat
Cedar
Chuch Koone
Chukuni
Cochrane
Cross
Eabemet
Ekwan
English
Equan
Fairy

ONTARIO—*Continued.*

Patricia (dist.)—*Con.*

Favourable
Fawn
Fishbasket
Fort Severn
Greenshields
Gullrock
Hair
Hudson
Kabania
Kah-mini-ti-qwa-quiack
Kakinookama
Kanuchuan
Kapikik
Kapiskau
Kapkichi
Kasagiminnis
Kay-gat
Kaypiscow
Kee-she-kas
Keigat
Kenozhe
Kishikas
Kishki
Lake of the Narrows
Little Cedar
Little Sachigo
Little Shallow
Lonely
Long-legged
Lower Clearwater
Machawaian
Makokibatan
Mamakwash
Mameigwess
Manitush
Margaret
Marten Drinking
Matawa
Medicine-stone
Meggisi
Michikamog
Michikenis
Michikenopik
Miminiska
Mimominatik
Misamikwash
Monsomshi
Nameins
Nankika
Nechigona
Nemeigusabins
Nibinamik
Nolin
Obashi
Ochig
Ogani
Opikeigen
Opinnagau
Oponask
Otoskwin
Ozhiski
Ozhuskans
Packhoon
Pagaonga
Pakhoan
Pakwash
Papaonga
Paquash
Pe-kange-kum
Pekangikum
Pepisquew
Pichinamei
Pickle
Pikangikum
Pizustigwan
Powingow
Red
Root
Sachigo
Sagaminnis
Sesikinaga
Seul
Severn
Shabumeni
Shagamu
Shakanch
Shallow
Shamattawa
Slate
Sogakwa
Sutton
Tabasokwia
Tashka
Totogan
Upinnakaw
Vermilion
Wadopi
Wagabkedei
Wai-nusk
Wapakik
Wapikopa
Wapitotem
Washagami
Washagomis
Washagummy
Washi
Weenisk
Weibikwei
Wenasaga
West Winisk
Whitefish Spawning
Whitestone
Wigwasikak
Williams
Windigo
Winisk
Winisk
Winiskisis
Winonitikameg
Wintawanan
Wizida
Wizidans
Woman
Wunnummin

Peel.

Caledon East
Campbell Cross
Campbell's Cross
Credit Forks
Derry
Derry West
East Caledon
Forks of Credit
Inglewood
Stanley Mills
Stanley's Mills

Perth.

Listowell
St. Marys

Peterborough.

Anstruther
Barrette
Bolger
Buzzard
Catchacoma
Chemung
Compass
Cox
Eagle
Gull
Jack
Kag-ish-a-bog-a-mog
Kasshabog
Ketchacum
Loucks
Mississagua
Oak
Pencil
Pilot
Serpentine
Shemong
Stony
Stoplog
Tallan

Prescott.

Atocas
Autaca
Azatika
Deseticaux
Dez Amecane
Fournier
Fournierville
Graisse
Gratton Corner
Great
Hamilton
Large
Little Nation
L'Orignal
McAlpine
Nation
Petite Nation
Rigaud
South Nation

Prince Edward.

Albury
Athol
Ameliasburg
Bald
Becroft
Big
Bigelow
Big Sandy
Cadman
Capt. John's
Carrying Place
Cedar
Charwell
Cole
Consecon
Cornwall Park
Cow
Egg
False Ducks
Foresters
Fox
Grape
Gravelly

ONTARIO—*Continued.*

Prince Edward—*Con.*

Green
Grove
Gull
Horse
Huff
Indian
Indian
Little Sandy
Massasauga
Miller
Muscote
Northport
Onderdonk
Ostrander
Owen
Pine
Pleasant
Potter
Prince Edward
Quinte
Rednersville
Robinson
Rossmore
Salmon
Salt
Salt
Scotch Bonnet
Ship
Smoke
Solmes
Solmesville
Sophiasburg
South
South Bay
Stoneberg
Stoneburgh
Swetman
Telegraph
Timber
Wallbridge
Way
Weller
Wellington
West
Wicked
Youngs

Rainy River (district).

Basswood
Bayley
Big Knife
Birch
Bottle
Cache
Carp
Chaudière
Chaudière
Crooked
Curtain
Cypress
English
Fort Frances
Hunter
Iron
Kettle
Knife
Koochiching
La Croix
Little Knife
Little Vermilion
Long Sault
Loon
Manitou
Melon
Merriam
Namakan
Nameukan
Namoukan
Nequaquon
Pooh-bah
Portage
Rainy
Saganaga
Sand
Sand Point (lake)
Seed
Seiganagah
Seiganagan
Seiganagaw
Swamp
Vermilion
Wawiag
Whitewood
Woods

Renfrew.

Allumette
Allumette
Bark
Barron
Beardwood
Blackfish
Carson
Cartier
Chalk
Chalk River
Charlotte
Corry
Curry's
Gorman
Greenan
Lève
McMaster
Madawaska
Paugh
Pembroke
Petawawa
Petewawa
Rockliffe
South Petawawa
Stonecliff
Sturgeon
Tucker
York

Russell.

Bearbrook
Bray
Bray's Crossing
Carlsbad Springs
Cheney
Cheney Station
Cobb
Eastman's Springs
Embrun
Little Nation
Martel
Martel Corners
Nation
Petite Nation
St. Onge
South Nation
The Lake

Simcoe.

Bond-Head
Carthew
Couchiching
Georgian
Glenhuron
Kempenfelt
McPhee
Penetanguishene
Simcoe

Stormont.

Black
Chrysler
Croil
Crysler
Dickinson Landing
Eamer
Farran Point
Harrison
Harrison's Corners
Hoople
Little Nation
McMillan Corners
Mille Roches
Monckland
Monklands
Nation
Osnabruck
Osnabruck Centre
Oznabruck
Petite Nation
Raisin
Raisins, Riv. aux
St. Andrews
Sheak
Sheek
Sheik's
Shieck
South Nation

Sudbury (district).

Katherine
Wahnapitae
Wakamagaming
Wakami
Wanapitei

Thunder Bay (district).

Aldridge
Allanwater
Arrow
Bagutchuan
Barbara
Barnard
Barrington
Beckington
Black Sturgeon
Bonnet
Brodeur
Brulé
Bukemiga
Caldwell
Campbell
Caribou
Carp

ONTARIO—*Continued.*

Thunder Bay (dist.)—Con.

Cat-tail
Chivelston
Cock
Crystal
Crystal
Davies
Dawson
Devizes
Edward
Elbow
Elizabeth
Emma
Eskwanonwatin
Esquanonwatin
Flatland
Fort William
Fowl
Frank
Frazer
Geikie
George
Georgia
Gouideau
Grand
Grand
Granite
Grassy
Great New
Greenbush
Grey
Gull
Gunflint
Gzowski
Hannah
Harris
Haystack
Heathcote
Hen
Houghton
Humboldt
Island Portage (lake)
Jarvis
Jean
Jean-Pierre
Jessie
Jojo
Kabitotikwia
Kabitotiquia
Kagianagami
Kaiashk
Kama
Kaministikwia
Kashaweogama
Kawakashkagama
Kawashkagama
Kawaweogama
Kawawiagamak
Kelvin
Kenogami
Kenny
Keshkabuon
Kopka
Lasher
Lily
Little Flatland
Logan
Lomond
Long
Lookout
Mackenzie
McEwen
McIntyre
McKay
McKellar
McLaurin
Magnet
Magnetic
Makokibatan
Manitou
Maria
Marshall
Martin
Masinabik
Mattice
Mazokama
Michipicoten
Middlebrun
Miminiska
Mission
Montreal
Moose
Mountain
Mud
Muddy
Murchison
Nameiben
Nepigon
Neston
Nipigon
Nonwatin
Nonwatinose
North
North Fowl
North Wind
Obonga
Oboshkegan
Obowanga
Ogoki
Ombabika
Onamakawash
Onaman
Onamanisagi
Opichuan
Orient
Pagwachuan
Parks
Partridge
Pashkokogan
Pawghtchewan
Pawgutchewan
Pickitigouching
Pigeon
Pijitawabik
Pijitawabekong
Pikitigushi
Pine
Pishidgi
Pittiwabikong
Port Arthur
Powgulchuan
Rabbit
Randolph
Rat
Reef
Robinson
Rose
Rove
St. John
Saganaga
Seiganagh
Seiganagan
Seiganagaw
Sapasook
Sapassoose
Sapasuk
Savant
Selwyn
Seseganaga
Shaganash
Shakespeare
Shangoina
Sharp Mt. (lake)
Sheepshank
Sheesheeb
Shesheeb
Silver
Smoothrock
South
South Fowl
Superior
Surprise
Swede
Tempest
Threemount
Tiernan
Triangle
Turtle
Wabakimi
Wabinosh
Wanogu
Watap
Waweig
Wawiag
Wawong
Wendigokan
Whiteclay
White's
Whitesand
Wigwasan
Windigo
Windigokan

Timiskaming (district).

Abitibi
Asipimocasi
Barber
Bass
Bear
Beaverhouse
Benson
Blanche
Cassidy
Clear
Cobalt
Crosby
Crown
Dawson
Farr
Friday
Gem
Gillies
Giroux
Goodwin
Gowganda
Grace
Haileybury
Hannah
Hannah Bay (river)
Harricanaw
Isabemagussi
Johnny
Johnson
Labyrinth
Larder
Latchford
Liskeard
Lorrain
Magusi
Mallon

ONTARIO—*Concluded.*

Timiskaming (dist.)—Con.

Martineau
Matabechawan
Matabitchuan
Mattagami
Montague
Montreal
Mud
New Liskeard
Nicol
Okikodosik
Peterson
Present
President
Prud'homme
Raven
Rib
Rousselet
St. Anthony
Sasaginaga
Sharp
S. Br. Moose R.
Sutton
Temiscaming
Temiscamingue
Temiskaming
Timiskaming
Wabi
Ward
Wright

Victoria.

Burnt
Montgomery
Young

Waterloo.

Galt
Mill
Nith river
Smith's creek

Welland.

Chantler
Chippawa
Chippewa
Gasline
German Mills
Waterloo
Welland

Wellington.

Galt
Glenallan
Mill
Puslinch
Schaw

Wentworth.

Binbrook
Blackheath
Clappison
Flamboro Centre
Flamboro East
Flamboro West
Galt
Harper Corners
Mill
Ryckman
Stony
Stoney
W. Flamboro
W. Flamborough

York.

Big Rouge Creek
Clairville
Don
Don
Eglinton
Elder
Elder Mills
Elder's Mills
Fox
Hagerman
Hagerman's Corners
Humber
Laskay
Laskey
Little Don
Milliken
Middletons
O'Sullivan
O'Sullivans Corners
Reesor
Rouge
Snake
Stouffville
W. Brch. Don R.
Wilcoks
Willcocks

PRINCE EDWARD ISLAND.

Kings.

East Souris
Hd. of St. Peter's Bay
Montague
Montague Bridge
Naufrage
Peters Road
Refuge
St. Peter
Shipwreck
Souris

Queens.

Grand Rustico
New Wiltshire
North Rustico
North Wiltshire
St. Peter
Wiltshire

Prince.

Big (or N.) Miminigash
Cascumpeque
Holland
Litile (or S.)Miminigash
Malpeque
Mimenegash
Minimegash
Princetown
Richmond
Roseville
Skinner Pond

QUEBEC.

Abitibi (territory).

Allard
Asinitchibastat
Assinika
Baxter
Bell
Broadback
Buck-hill
Cabane
Chebistuanonekau
Chensagi
Chibougamau
Coban
Cold
Cone
Dome
Eatchepashi
Elizabeth
Etchipotchi
Evans
Florence
Geikie
Gizzard
Hannah Bay (river)
Harricanaw
Height-of-land
Hugh
Ice
Iserhoff
Kamshigama
Kaniapiskau
Kelvin
Keniapiskau
Kenoniska
Kiask
Kirk
Kitchigama
Lady Beatrix
Little Nottaway
Long
Maikasksagi
Mattagami
Mattagami
Michagama
Middleton
Mikwasach
Mishagomish
Mistawak
Natchipotchi
Nipukatasi
Noddawai
Nodway
Northeast
Nottaway
Obatawagush
Obatogamau

QUEBEC—*Continued.*

Abitibi (territory).—*Con.*

Olga
Opamiska
Opatawaga
Opawika
Opemiska
Opiwatakan
O'Sullivan
Otchisk
Pijuwyan
Puskitamika
Rabbit
Rapid
Reid
Scott
Soskumika
Southwest
Surprise
Taibi
Tshensagi
Victoria
Waswanipi
Wawagosik
Wedding
Wemistagosew
West
Wetetnagami

Argenteuil.

Beechridge
Dalesville
Greece Point
Hillhead
Kingham
Kingsey
Mid. Br. West (river)
St. Andrews
Ste. Perpétue

Ashuanipi (territory).

Atikonak
Attikonak
Bowdoin
Groswater
Kenemich
McLean
Melville
Rigolet
St. John

Bagot.

Actonvale
Clairvaux-de-Bagot
St. Dominique-de-Bagot
St. Hector
St. Hector de Bagot
Ste. Hélène-de-Bagot
St. Simon-de-Yamaska
St. Theodore-d'Acton

Beauharnois.

Buisson
Cartier
Cartierville
De Salaberry
Grand
St. Etienne-de-Beauharnois
St. Stanislas-de-Kostka

Bellechasse.

Abenakis
Abenaquis

Berthier.

Askwahani
Eskwahani
Kapitachuan
Kapitajewan
Kapitashewinna
Mashamengoose
Matashi
Matawa
Matawin
Mattawin
Mejomanguse
Menjobaguse
Mitchinamekus

Bonaventure.

Baie des Chaleur
Caplan
Chaleur
Cross
Crosspoint
East
Goacha
Maguacha
Maguasha
Matapedia
Metapedia
Migoacha
Miguacha
New Richmond
Pointe-à-la-Garde
Port Daniel
Port Daniel East
Restigouche
Richmond
Ristigouche
St. André-de-Ristigouche
St. Chas.-de-Caplan
St. George Port Daniel
West
West Port Daniel

Brome.

Call Mill
Glensutton
Drummondville Junction
Sutton Junction

Chambly.

Chambly
St. Lambert

Champlain.

Assiwanan
Atem
Atim
Chakwa
Chisaouatasi
Citrouille
Great Beaver
Hair Cutting
Kamitsgamak
Kapitswe
Kekeo
Kickendatch
Kikendatch
Kirkendatch
Mâle
Manuan
Mashamengoose
Matawa
Matawin
Mattawa
Mattawin
Mejomanguse
Mekinak
Menjobaguse
Mitchinamekus
Mondonak
Najan
Obiduan
Onkammis
Oskelaneo
Pasiminikana
Pitopiko
Proud-sitting
Ribbon
Ruban
Sackawatisi
St. Maurice
Sandy-beach
Sassawatisi
Travers
Wayagamak
Weymontachi
White Bear

Charlevoix.

Baie-St.-Paul.
Brandypot
Cap-à-l'Aigle
Comporté
Corneille
Coudres
Eagle
Goose
Jareux
Jean-Noël
Jureux
LeHeu
Malbaie
Malloux
Murray
Murray Bay
Noire
Oies
Persil
Pointe-au-Pic
Port-au-Persil
Port-au-Saumon
Pot-à-l'eau-de-vie
Rochers
Sain
St. Etienne
St. Fidèle
St. Irénée
St. Paul's Bay
St. Simeon
Salmon
Saumon

QUEBEC—*Continued.*

Chateauguay.

Allan Corners
Fèves
Rivière-des-Fèves
St. Urbain-de-Chateauguay

Chicoutimi.

Askitichi
Foamfall
Hache
Ha Ha
Jonquière
Kapititegoitch
Kenogami
Metabetchouan
Nikabau
Pipmakan
Pitmuakin

Compton.

Ste. Edwidge
St. Francis
St. François

Drummond.

St. Francis
St. François
Wickham
Wickham West

Frontenac.

Adstock
Aylmer
Coldstream
Courcelles
Price
St. Francis
St. François
Springhill

Gaspe.

Anse-à-Beaufils
Anse-au-Vallon
Beaufils (anse à)
Bonfils
Brion
Bryon
Byron
Cap Chat
Cap-de-Chate
Cape Chatte
Chlorydorme
Cloridorme
Cloridon
Cross
Despair
Espoir
Gaspe
Gaspé
Grande-Anse
L'Anse au Beaufils
L'Anse-à-Valleau
Macquereau
Maquereau
Martin
Martre
Rivière-à-la-Martre
Ste. Anne-des-Monts

Hochelaga.

Back
Côte-des-Neiges-Ouest
Longue-Pointe
Nuns
Prairies
Rivière-des-Prairies
St. Helen
Ste. Hélène
St. Paul

Huntingdon.

Anderson Corners
Calvin Grove
Carr
Carr's Crossing
Clyde Corners
Coffey
Coffey's Corners
Cowan
Hinchinbrook
Kelvingrove
Maybank
O'Neil
O'Neill's Corners
Port Lewis
Port Louis
Ste. Agnès-de-Dundee
St. Regis
Starnesboro
Whites

Iberville.

Mount Johnson
St. Alexandre
Ste. Brigide
St. Gregoire

Jacques Cartier.

Allan
Back
Bizard
Caron
Dowker
Ile-Bizard
Isle Bizard
Lynch
Macdougall's
Marion
Marion
Orme
Prairies
Ste. Anne-de-Bellevue
Ste. Anne du bout de L'Ile
St. Genevieve
St. Laurent
St. Laurent, Montreal
Tortue
Valois
Valoisville

Joliette.

Askwahani
Eskwahani
Kapemitchigama
Kapitajewan
Kapitashewinna
Kapitachuan
Matawa
Matawin
Mattawin
Tunagamik

Kamouraska.

Caps
Diable
Dumais
Ferme
Fouquette
Goudron
Julien
Kamouraska
Moreau
Orignaux
Pélerins
Pilgrim
Pohenagamuk
St. André
St. Denis
St. Germain

Labelle.

Arcand
Arcans
Arosen
Cardinal's
Charlebois
Commandant
Kinonge
Montebello
Mont-Laurier
Nation
Nomining
North Nation
Papineau
Petite Nation
Rousseau
Roussin
Ste. Rosalie
St. Sixte
Salmon
Sincique
Sugarbush

Lake St. John

Alex
Ashuapmuchuan
Commissioners
File-axe
Mistassibi
Muskosibi
Ouasiemska
Peribonka
Pipe
St. Louis-de-Chambord
St. Maurice
Ticouabi
Tikonabi
Tikuape
Washimeska
Wassienska

Laval.

Back
Bélanger
Tétreauville
Parc-Laval
Prairies
Village Belanger

QUEBEC—*Continued.*

Lévis.

St. Henri
St. Henri Station

L'Islet.

Algernon
Roche à Veillons
St. Pamphile
St. Roch-des-Aulnaies
South

Lotbiniere.

Deschaillons
Eschaillons
Pointe-Platon
Langlais
Langlois
St. Antoine-de-Tilly
St. Antoine, Lotbinière
Ste. Emelie
Ste. Emilie
Ste. Emmélie
St. Jean Deschaillons

Maskinonge.

Kapitajewan
Kapitashewinna
Kapitachuan
Mashamangoose
Matawa
Matawin
Mattawin
Mejomanguse
Menjobaguse
Mitchinamekus
Nemikachi

Matane.

Causapscal
Cosupscoult
Great Metis
Matapedia
Metapedia
Metis
Mitis
Ste. Angèle-de-Rimouski
Taouagadec
Tawagadik
Tawagodi

Megantic.

Bécancour
Bigsby
Black
Clapham
Coldstream
Coleraine
Colraine
Ireland
Lake Megantic
Megantic
Robertson
Robertson Station
Sacré-Coeur-de-Marie
St. Antoine-de-Pontbriand
Thetford

Missisquoi.

Abbott Corners
Farnham Corners
Meig
Meigs Corners
Nutt
Nutt's Corners

Mistassini (territory).

Abatagush
Albanel
Cabistachuan
Chabatok
Cooper
Kabistachuan
Kanotaikau
Kokomenhani
Little Mistassini
Marten
Miskittenau
Mistassini
Mistassinis
Mokwawastuk
Namiska
Nemiskau
Pinched-neck
Pontax
Pontiac
Poplar
Punichuan
Robert
Rupert
Tesaycau
Tesekau
Wahwanichi
Wakinichi
Wakonichi
Wettigo

Montcalm.

Akos
Bear-grease
Bouchette
Kakashe
Kamachigama
Kapitachuan
Kapitajewan
Kapitashewinna
Namegos
Namegosis
Nemegos
Nemegosis
Nipmenanni
O'Sullivan
Shesheinquan
Shoshokwan
Tapani

Montmagny.

Lacaille
St. Paul-du-Buton

Montmorency.

Cap Brulé
Grand Lake Jacques Cartier
Jacques Cartier
Montée du Lac
Montée du Lac

New Quebec (territory).

(*Ungava.*)

Abloviak
Akpatok
Akpatok
Akwatuk
Alukpaluk
Aquatuk
Aukpatuk
Beacon
Bennett
Big
Big Rock
Bishop Roggan
Bowdoin
Burgoyne
Burwell
Button
Cairn
Cape of Hopes Advance
Charles
Chidley
Chimo
Chudleigh
Comb
Deception
Diana
Doctor
Douglas
Dyke
Eastmain
Eider
Fisher
Fort Chimo
Fosters
George
Goose
Gray
Great Bishop Roggan
Grey Goose
Gyrfalcon
High Fall
Hopes Advance
Hudson
Inukshiligaluk
Inukshuktuynk
Ittimenoktok
Jacob
Joy
Junnusuksoak
Kangerthialuksoak
Kaniapiskau
Kattaktok
Katutok
Keglo
Kenogamissee
Kernertut
King George
Koksoak
Kyak
Labrador reef
Larch
Leaf
Little Charlton
McLean
McLean
McLelan
Maiden
Manitounuk
Moses Oates
Nauyats
Nedluk

QUEBEC—*Continued.*

New Quebec (territory)— *Con.*

Nephjee
Neptune Head
North
Old Factory
Omanek
Opinaca
Opinaka
Pauktorvik
Payne
Petatstekupau
Petishikupau
Petitsikapau
Petshikupau
Plover
Prince Henry Foreland
Prince of Wales
Richmond
Roggan
Seal
Shedlui
Solomons Temples
South
Stimukoktok
Straight
Stupart
Tasurak
The Wart
Tisiriuk
Trodely
Tunnussaksuk
Tuttle
Tuvalik
Uibraksoak
Uinaksoak
Wakeham
Wales
Wauguash
Weggs
Whale
Whitley
Wiachuan
William Smith
Wood

Nicolet.

Godfroy
Manseau
Moran
Moras
St. Pierre des Becquets
St. Pierre les Becquets
St. Pierre les Bequets

Ottawa.

Aylmer
Deschênes
Deschênes Mills
Gatineau Point
Gens-de-terre
Grand Lac du Commissaires
Jean de Terre
Kazabazua
Kiamika
Kirk Ferry
Lapêche
McLaren
McLaurin
Mushonga
Ottawa
Pemichangan
Penichangan
Remic
Remous
Thirty-one-mile
Wabassi
Wilson Corners

Pontiac.

Anwatan
Armstrong
Atik
Atikosipi
Barriere
Birch
Burnt Bay
Chartier
Downey
Dozois
Garden Island (lake)
Gens-de-terre
Jean de Terre
Kabona
Kahuch
Kakabonga
Kakebonka
Kampigukakatoka
Kanikawinika
Kanimitti
Kanusio
Kapitachuan
Kapitajewan
Kapitashewinna
Katonche
Kazabazua
Kekek
Lapécho
Mackey
Macoostigan
Makustigan
Matchimanito
Megiskun
Mekiscan
Metchiskan
Metiscan
Migiskan
Millie
Nipmenanni
Opequanne
Opequon
Opikwan
Paskagama
Quio
Quyon
Rapides
Shabogama
Shamus
Shesheinquann
Shoshokwan
Sifton
Thomasine
Tomasine
Wajabakoute
Washeka
Waskega
Wetetnagami
Whitegoose
Wotinimata

Portneuf.

Dombourg
Donbour
Frechette
Lac-Sergent
Pierre
Rivière-à-Pierre
St. Casimir
St. Marc-des-Carrières
Sergent
St. Basile-de-Portneuf

Quebec.

Biart
Epaule
Kajoualwang
Kakisksagamak
Kamamintigongue
Kamilikamac
Lescarbot
Najualand
Najwalwank
Notre-Dame-des-Laurentides
Ste Foy
Ventadour

Richmond.

St. Francis
St. François

Rimouski.

Arignole
Mistigouche
Mistigoueéche
Mistikus
Orignal

Rouville.

Ange Gardien de Rouville
Barbue
Barbue de St. Césaire
Belocil
Canrobert
Iluron
L'Ange Gardien
Marieville
Papineau d'Abbotsford
Richelieu
Rouville
St. Hilaire
St. Michel-de-Rougemont
Village Richelieu

Saguenay.

Alouettes
Bason
Bersimis
Betsiamits
Bouleau
Chaloupe
Choniaban
Eau Dorée
Englishman's
Eskimo
Esquimaux
Fall
Godbout
Goodbout

QUEBEC—*Continued.*

Saguenay—*Con.*

Harrington
Ichimanicuagan
Ile aux Morts
Ishimanikuagan
Jupiter
Jupiter
Lark
Lark
Little Mecattina
Little Natashquan
Manicuagan
Manicouagan
Manikuagan
Marguerite
Martimoki
Mecatina
Mekattina
Mille-Vaches
Moisie
Monts
Mooshaulagan
Mouchalagan
Mushalagan
Muskwaro
Nabesipi
Nabesippi
Nabisipi
Napetipi
Natashkwan
Natashquan
Observation
Olomanoshibo
Pashashibu
Peashteebee
Pentecôte
Pepechekau
Piashti
Piastre
Pikapao
Pikopao
Pipishikan
Pointe-des-Monts
Quetachu
Romaine
St. Augustin
St. Augustine
Ste. Marguerite
Ste. Marguerite
Sassaganaga
Sault-au-Cochon
Saut de Cochon
Saut de Monton
Sawbill
Sept Iles
Seven Islands
Shallop
Shecatica
Shekatika
Sheldrake
Sholiaban
Souriban
Sourilaban
Southwest
Tadoussac
Takameshau
Todnustook
Toolnustook
Tortue
Tulnustuk
Waputstagamu
Washikuti
Washsheecootai
Watcheeshoo
Watsheeshoo
Watshishu

St. Hyacinthe.

St. Barnabé-R.-Yamaska
St. Joseph-de-St. Hyacinthe

St. Johns.

Belle-Vallée
Fort Lennox
Ile-aux-Noix
Meule
Noix
North of Halfway
St. Bernard-Sud
St. Valentin

St. Maurice.

Aigles
Eagle
Glaises
Goldfinch
Kawaskisigat
Kawasgisguegat
Kempt
Loutres
Mashamengoose
Matawa
Matawin
Mattawin
Mejomanguse
Menjobaguse
Mitchinamekus
Pakonsigane
Pieromouta
St. Maurice
Shawenegan
Wabaskoutyunk
Wagwabeya
Wagwabika

Shefford.

Grandboro
Milton
Milton East
Rochelle
Roxton East
St. Alphonse-de-Granby
Ste. Anne-de-Stukely
Ste. Cecile-de-Milton
St. Joachim-de-Shefford
Savage

Sherbrooke.

Ascot
Little Magog
Magog
St. Francis
St. François
Sherbrooke

Soulanges.

Baudet
Beaudet
Bodet
Bouleau
Cedars
Chateauguay
Dadancourt
Dalhousie Mills
Dalhousie Station
D'Alogmy
De Beaujeu
Giroux
Grande Batture
Grande Ile aux Erables
Joubert
Lalonde
Leonard
Maple
Petite Ile aux Cygnes
River Beaudette
Round
Sévigny
Soulanges
Thorn

Stanstead.

Baldwin's pond
Barnston pond
Little Magog
Magog
Lyster

Temiscouata.

Barrett
Cabano
Cacouna
Coudres
Demers
Fraserville
Frazerville
Hare
Lièvres
Loup
Marmen
Notre-Dame-du-Portage
Rivière-du-Loup
Roche-Percée

Terrebonne.

Achigan
L'Achigan
Rouge
Ste. Thérèse-de-Blainville

Timiskaming.

Abbika
Abitibi
Agotawekami
Amikitik
Amos
Apika
Asapikona
Asipimocasi
Askikwaj
Atikamek
Atikmahik
Bagwah
Bass
Bear
Beauchamp
Beaudry
Bell
Bellefeuille
Big

QUEBEC—*Concluded.*

Timiskaming—Con.

Big Obashing
Blouin
Brownwater
Brushy
Careajou
Caron
Chief
Chikobi
Christopherson
Clay
Coffee
Cremazie
Crooked
Darlens
Dasserat
Davy
De Montigny
Dufault
Dufay
Dufresnoy
Dumoine
Duparquet
Eagle
Eel
Eel
Evain
Expanse
Faucher
Figuery
Fish
Fisher
Fréchette
Gaboury
Gaotanaga
Grand
Grand lake Victoria
Hannah Bay (river)
Harricanaw
Hébécourt
Hébert
High Water
Isabemagussi
Island
Islands
Jacob
Kaishk
Kajakanikamak
Kakameonan
Kakinokamak
Kamoukakwiti
Kanasuta
Kapitagama
Kawasachuan
Kawastagnta
Kcec
Kee-ec-kee-ec
Keepawa
Kekeko
Kewagama
Kewagodoongojioon
Kiekkiek
Kiemawisk
Kienawisik
Kinojevis
Kipawa
Kokomis
Laberge
Labyrinth
Lake of Islands
LaMotte
Lamy
La Pause
Lartigue
LaSarre
Lemoine
Lily
Little Rogers
Lizard
Lois
Lonely
Long
Lorenzo
Maganasibi
Magnsi
Makamik
Mance
Mann
Matamik
Mattawagosik
Mekamic
Merrill
Mishomis
Molesworth
Moosehorn
Mourier
Mud
Namawash
Nawapitechin
Newagama
Obadowagashing
Obalski
Obashing
Obaska
Obikoba
Obiska
Octave
Okikodosik
Opasatika
Osisko
Otanabi
Pakitanika
Pelletier
Piché
Pontleroy
Quinze
Rest
Robertson
Roger
Rogers
Routhier
Rouyn
Rush
St. Eugène-de-Guignes
Seals Home
Shi-shi-shi
Simon
Sleepy
Spirit
Stewart
Sturgeon
Temiscaming
Temiscamingue
Temiskaming
Tiger
Timiskaming
Vaudray
Villemontel
Wabanoni
Wabaskus
Wabinoni
Wapusanan
Whitefish
Wikwaskapauk
Winawiash

Two Mountains.

Chicot
La Chapelle
Petit Chicot
St. Columban
Ste. Monique
Ste. Monique des Deux Montagnes

Vaudreuil.

Bruey's
Brussy
Dorion
Graham
Graisse
Green Valley
Ile Perrot
Lavigne
Point Fortune
Raquette
Rigaud
Vaudreuil
Verte-Vallée

Wolfe.

Aylmer
Bisby
Belmina
Breeches
Colombe
Coulombe
Garthby
Garthby Station
St. Francis
St. François
Stratford
Ward
Wolfestown

Yamaska.

St. Francis
St. François

SASKATCHEWAN.

Acheninni
Aiktow
Alcott
Anerley
Antler
Arcola
Arm
Armit
Armitt
Aroma
Ashe
Attitti
Ballantyne
Barrel
Basin
Basquia
Battle
Battleford
Bear
Bear Lake (river)
Beaver
Beaver
Bergheim
Big Cutarm
Big Quill
Big Sturgeon
Birchbark
Björk
Blackfeet
Blaine
Bonald
Bowtree
Brightsand
Bronson
Buffalo Pound
Buffer
Bull's Forehead
Cabri
Cactus
Calder
Candle
Caribou
Carrot
Chapleau
Chaplin
Chitek
Churchill
Clearwater
Clearwater
Cold
Cole
Copeau
Cosine
Coteau
Cottonwood
Cowan
Crayfish
Crean
Crooked
Crooked
Cross
Cumberland
Cutarm
Cutknife
Cypress
Deschambault
Dirtywater
Doctor
Duck
Duck
Duck Lake
Eagle
Eagle
Eaglehill
Ear
Ecapo
Echo
Ens
Ekapo
Englishman
Etoimami
Etoimami South
Etomami
Eyebrow
Eyehill
Farrier
Fife
File
Fir
Fish
Fishing
Foam
Forks
Frenchman
Frobisher
Gainsborough
Garden
Gap
Garson
Goose
Goosehunting
Gordon
Graham
Grassberry
Grassy
Great Bear Sand (hills)
Hanging Hide
Heron
Highpound
Highview
Hillfarm
Horsehead
Houghton
Houghton
Humboldt
Indian Pear
Iriquois
Iskwatikan
Island
Jackson
Jansen
Johnston
Jumping
Jumping Deer
Kakinagimak
Kakinokumak
Kamatsi
Kaposvar
Katepwe
Keg
Killsquaw
Kiyiu
Kutawagan
Kyaska
Lacolle
Ladder
La Loche
Lavallée
Lawrence
La Ronge
Leather
Lebret
Lenore
Lilian
Little Candle
Little Cutarm
Little Fishing
Little Island (lake)
Little Pelican
Little Quill
Little Red
Lobster
Lodge
Long
Long
Loon
Lowes
Macleod
McFarlane
McMurray
Madge
Makwa
Manawan
Manito
Many Island (lake)
Maple
Maple
Maskwa
Meadow
Medicine Lodge
Meeting
Melfort
Merion
Methye
Midnight
Mincronie
Minnedosa
Ministikwan
Mirond
Missinnippi
Montague
Montreal
Moose
Moose
Moosejaw
Morin
Mudie
Mudjatik
Mukoman
Murray
Muskiki
Muskwesi
Namew
Neale
Negik
Nemei
Nemeiben
North Antler
Notukeu
Nut
Old Wives
Okemasis
Opachuanau
Opuntia
Pachewanow
Paddling
Pagato
Paquin
Pasquia
Patience
Payoonan
Pebble
Peck
Pelican
Peonan
Pheasant
Piapot
Pine Island (lake)
Pink
Pinto
Pita
Ponass

SASKATCHEWAN—*Concluded.*

Porcupine
Potato
Presbyterian
Primeau
Primrose
Qu'Appelle
Quill
Rapid (river)
Rapid River (lake)
Rat
Redberry
Red Deer
Red Deer
Red Deer lakes
Reindeer
Rivers
Roche Percée
Root
Round
Saskeram
Scentgrass
Seagram
Seepanock
Shaver
Shell
Shellbrook
Silver
Sipanok
Sisipuk
Souris
South Antler
Spruce
Stockwell
Stone
Stony
Sturgeon
Sturgeon-weir
Sucker
Suggi
Taggart
The Coteau
Thickwood
Thunder
Torch
Touchwood
Trade
Tramping
Trout
Upper Fishing
Valleyview
Vermilion
Voisin
Wakaw
Wapawekka
Wapoos
Wapus
Wasawakasik
Wascana
Waskana
Waskesiu
Weed
Whitebear
Whitefish
Whitefox
White Mud
Whitesand
Whiteshore
Whitewood
Willowbunch
Wintego
Witchekan
Wiwa
Wrench
Wood
Wood Mt. (river)
Woody

YUKON.

Adams
Aishihik
Alki
Allgold
Alligator
Alma
Alsek
Ammerman
Anderson
Annie
Anticline
Arkansas
Arkell
Atlin
Australia
Bach
Baker
Bald
Bear
Beaton
Beaver
Becker
Bedrock
Bell
Benson
Berney
Big Salmon
Bird
Bisel
Blackfox
Blanchard
Bonanza
Boswell
Boulder
Boundary
Braeburn
Brantnober
Brewer
British
Browns
Bryant
Bunker
Burnham
Burns
Burton
Bush
Calder
Calf
Campbell
Canyon
Carbon
Carcross
Caribou
Caribou
Caribou Crossing
Carmack
Cassiar
Cave
Chandindu
Chieftain
Christie
Clear
Clinton
Clondyke
Coal
Cone
Conrad
Cooper
Corwin
Crater
Crooked
Cudahy
Dail
Dalton
Daoust
Davidson
Davis
Dawson
Dawson City
Deadwood
Dewdney
Dezadeash
Dickson
Dion
Disella
Division
Dognose
Dollis
Dome
Dominion
Donjek
Duckie
Dundalk
Eagle Nest
Earn
Edith
Eldorado
Emil
Ensley
Ethel
Eureka
Fairfield
Fay
Fenwick
Field
Finger
Finlayson
Five-finger
Flat
Florence
Follé
Fort Selkirk
Fortynine
Frances
Frederick
Fresno
Friday
Galena
Garnet
Gilliam
Glacier
Gladman
Glenlyon
Gnat
Gold
Goldbottom
Golden
Golden Horn
Gold-run
Granger
Granite
Gray
Green
Grizzly
Gull

YUKON—*Continued.*

Gustavus
Haeckel
Haggart
Haldane
Hall
Hancock
Harper
Harris
Hart
Healy
Henderson
Hendon
Henrietta
Hess
Hester
Hinton
Hodnett
Hoole
Hootalinqua
Hopkins
Horton
Hunker
Hutshi
Hutshiku
Illes
Independence
Indian
Ingram
Itsi
Janet
Jensen
Jim
Joel
John
Johnston
Joy
Jubilee
Kalzas
Kaskawulsh
Katrina
Keele
Ketza
Kitza
Klatsa
Klokhok
Klondike
Klotassin
Klotz
Kluane
Kluhini
Klukshu
Klusha
Koidern
Kusawa
Kusiwah
Kwichpak
Laberge
Ladue
Lake
Lansdowne
Lansing
Lapie
Last-chance
Laura
Laurier
Lebarge
Leotta
Lewes
Lewis
Lewis
Liard
Little Atlin
Little Blanche
Little-gem
Little Salmon
Logan
Lombard
Lorne
Lubbock
Lucky
Macmillan
M'Clintock
McConnell
McEvoy
McNeil
McPherson
McQuesten
Malcolm
Maloney
Marsh
Mary
Matheson
Maunoir
Mayo
Meadow
Mendenhall
Michaud
Michie
Miles
Miller
Milton
Miners
Minnie Bell
Mint
Mistake
Monson
Montana
Moose
Moosehide
Morley
Morrison
Mosquito
Mountain
Nahoni
Nares
Narchilla
Needle
Nello
Nevin
New Zealand
Nipple
Nisling
Nisutlin
Nogold
Nordenskiöld
North
O'Brien
O'Connor
Ogilvie
Oldman
Oldwoman
Ophir
Orchay
Ortell
Osgood
Ottawa
Parker
Partridge
Pelly
Perkins
Perthers
Perthes
Peterson
Pitts
Poker
Porcupine
Porter
Povoas
Prejevalsky
Prevost
Ptarmigan
Pugh
Pyramid
Quartz
Quebec
Quiet
Quinn
Rawlinson
Reid
Reindeer
Remington
Richthofen
Riddell
Rink
River (mtn.)
Rob Roy
Rogue
Rose
Rosebud
Ross
Ruby
Saint-Cyr
St. Hilary
Satasha
Sayia
Sayyea
Schnabel
Schwatka
Scroggie
Sekulmun
Selkirk
Selous
Selwyn
Semenof
Shakwak
Sheep
Sheldon
Sifton
Simmons
Simpson
Simpson Tower
Sixty
Sixtymile
Slate
Small Duck
Soda
Stake
Star
Starr
Stevens
Stewart
Stony
Stutzer
Sulphur
Sunday
Surprise
Swede
Tagish
Tahte
Takhini
Taku
Taltmain
Tantalus
Tasin
Tatchun
Tatonduk
Tatshenshini
Tay
Taye
Terrace
Teslin
The Three Guardsmen

YUKON—*Concluded.*

Thistle
Thomas
Thompson
Thron-diuck
Til-e-i-tsho
Tillei
Tintina
Tlet-tlan-a-tsoots
Too-flat
Too-much-gold
Too-tlas
Tower
Traffic
Tummel
Tustles
Tyers
Unahini
Vancouver
Vesuvius
Von Wilczek
Vowle
Walker
Ward
Watson
Wellesley
Wesketahin
Wheaton
White
Whitehorse
Whitestone
Wilson
Windy
Wolf
Woodside
Yukon

NORTHWEST TERRITORIES (Unorganized)

A. H. Ward
Akuling
Allen
Anderson
Archibald
Ark-e-leenik
Arthur Land
Ashe
Ava
Axel Heiberg
Backs
Back's Western
Baffin
Banks
Baring
Bathurst
Bear
Beaumont
Bedford
Beekman
Best
Bishop
Blanford
Blunt
Bonney
Bosanquet
Brevoort
Bruce
Butler
Carys Swan Nest
Cathawhachaga
Chamberlain
Chase
Chorkbak
Christie
Chudliasi
Church
Clark
Clements Land
Clinton-Colden
Cockburn
Colmer
Cornwall
Cornwallis
Countess Warwick.
Crete
Crooks
Cumberland
Cyrus Field
Dahadinni
Delthore
Devon
Diamond
Doobaunt
Dubawnt
Dyer
Earl Grey
East
Edith
Eduni
Egypt
Ehkwee
Ekwi
Ellesmere
Emma
Fair Ness
Findlay
Finlay
Fisher
Fletcher
Fox
Fox
Foxe
Frank Clark
Frobisher
Gabriel
Glasgow
Glencoe
God's Mercie
Gods Mercy
Gordon
Govan
Grant Land
Gravel
Great Bear
Great Fish
Greenwood Land
Griffin
Grinnell
Grinnell Land
Hall
Harbour
Hatton
Haven
Hector
Henderson
High
Hogarth
Home
Icy
Inlin
Innarulligang
Irving
Jackman
James
Jessup Land
Jordan
Jubilee
Julian
Ka-lik-took-duag
Kangerflung
Kathawachaga
Keele
Khartum
King Christian
King Oscar Land
King William
Kitigtung
Klewi
Kneeland
Korikduardu
Lady Franklin
Laurier
Liard
Lockhart
Leopold
Loks Land
Lower Savage
Lubbock
Luke Fox
Lumley
Macdonald
Mansel
Mansfield
Markham
Middle Savage
Montrose
Monumental
Mountain
Murchison
Murray
Nainlin
Natla
Newell
Newton
Nidhe
Noel
North
North Cornwall
North Devon
North Foreland
North Lincoln
North Somerset
Northumberland
Nyarling
Olga
Overflow
Penny
Pethinue
Prince Albert Land
Prince Albert peninsula
Prince of Wales
Prince of Wales
Prince Patrick
Pritzler
Queen Elizabeth
Ramsay
Rawson
Reeves
Resolution
Resolution
Ringnes
Robert
Robinson

NORTHWEST TERRITORIES (Unorganized)—*Concluded.*

Roes Welcome
Ross
Rowes
Saddleback
Sass
Sass-tessi
Savage
Sayunei
Schley Land
Sekwi
Setidgi
Shezal
Siggia
Sitidgi
Somerset
Spicer
Strathcona
Sylvia Grinnell
Tchork-back
Tess-Clewee
Thelew
Thelon
Thleweechodezeth
Toohoolitas
Tornait
Tsichu
Tudjakdjuan
Tudjakdjudusirn
Tuhulitas
Twitya
Upper Savage
Victoria
Waddell
Ward
Warwick
Westbourne
Western
West Fox
Wharton
White
White Bear
Wholdia
Wollaston
Wollaston Land
York

COUNTIES IN CANADA.

New Brunswick.

Albert
Carleton
Charlotte
Gloucester
Kent
Kings
Madawaska
Northumberland
Queens
Restigouche
St. John
Sunbury
Victoria
Westmorland
York

Nova Scotia.

Annapolis
Antigonish
Cape Breton
Colchester
Cumberland
Digby
Guysborough
Halifax
Hants
Inverness
Kings
Lunenburg
Pictou
Queens
Richmond
Shelburne
Victoria
Yarmouth

Ontario.

Addington
Algoma (district)
Brant
Bruce
Carleton
Dufferin
Dundas
Durham
Elgin
Essex
Frontenac
Glengarry
Grenville
Grey
Haldimand
Haliburton
Halton
Hastings
Huron
Kenora (district)
Kent
Lambton
Lanark
Leeds
Lennox
Lincoln
Manitoulin (district)
Middlesex
Muskoka (district)
Nipissing (district)
Norfolk
Northumberland
Ontario
Oxford
Parry Sound (district)
Peel
Perth
Peterborough
Prescott
Prince Edward
Rainy River (district)
Renfrew
Russell
Simcoe
Stormont
Sudbury (district)
Thunder Bay (district)
Timiskaming (district)
Victoria
Waterloo
Welland
Wellington
Wentworth
York

Prince Edward Island.

Kings
Prince
Queens

Quebec.

Abitibi (territory)
Argenteuil
Arthabaska
Ashuanipi (territory)
Bagot
Beauharnois
Beauce
Bellechasse
Berthier
Bonaventure
Brome
Chambly
Champlain
Charlevoix
Chateauguay
Chicoutimi
Compton
Dorchester
Drummond
Frontenac
Gaspe
Hochelaga
Huntingdon
Iberville
Jacques Cartier
Joliette
Kamouraska
Labelle
Lake St. John
Laprairie
L'Assomption
Laval
Lévis
L'Islet
Lotbinière
Maisonneuve
Matane
Maskinongé
Megantic
Missisquoi
Mistassini (territory)
Montcalm
Montmagny
Montmorency
Montreal (9 subdivisions)
Napierville
Nicolet
Ottawa
Pontiac
Portneuf
Quebec
Richelieu
Richmond
Rimouski
Rouville
Saguenay
Shefford
Sherbrooke
Soulanges
Stanstead
St. Hyacinthe
St. Johns
St. Maurice
Temiscouata
Terrebonne
Timiskaming
Two Mountains
Vaudreuil
Verchères
Westmount
Wolfe
Yamaska

TOWNSHIPS IN ONTARIO.

Township.	County or District.
Aberdeen	Algoma.
Abinger	Addington.
Adams	Timiskaming.
Adelaide	Middlesex.
Adjala	Simcoe.
Admaston	Renfrew.
Adolphustown	Lennox.
Airy	Nipissing.
Afton	Sudbury.
Albemarle	Bruce.
Albert	Algoma.
Albion	Peel.
Aldborough	Elgin.
Alexandra	Timiskaming.
Alfred	Prescott.
Algoma, North	Renfrew.
Algoma, South	Renfrew.
Alice	Renfrew.
Allan	Manitoulin.
Allen	Sudbury.
Alma	Timiskaming.
Alnwick	Northumberland.
Amabel	Bruce.
Amaranth	Dufferin.
Ameliasburgh	Prince Edward
Ames	Thunder Bay.
Amherst Island	Lennox.
Amundsen	Algoma.
Amyot	Sudbury.
Ancaster	Wentworth.
Anderdon	Essex.
Anderson	Algoma.
Anglesea	Addington.
Anglin	Nipissing.
Anson	Haliburton.
Anstruther	Peterborough.
Antoine	Nipissing.
Appleby	Sudbury.
Arcadia	"
Archibald	Algoma.
Argyle	Timiskaming.
Armagh	Sudbury.
Armour	Parry Sound.
Armstrong	Timiskaming.
Arnold	"
Arran	Bruce.
Artemesia	Grey.
Arthur	Wellington.
Ashby	Addington.
Ashfield	Huron.
Askin	Nipissing.
Asphodel	Peterborough.
Asquith	Sudbury.
Assiginack	Manitoulin.
Aston	Nipissing.
Athol	Prince Edward.
Atwood	Rainy River.
Aubin	Timiskaming.
Aubrey	Kenora.
Auden	Algoma
Augusta	Grenville.
Auld	Timiskaming.

Township.	County or District.
Aurora	Timiskaming.
Awenge	Algoma.
Aweres	"
Awrey	Sudbury.
Aylmer	"
Aylsworth	Rainy River.
Baden	Timiskaming.
Badgerow	Nipissing.
Bagot	Renfrew.
Bain	Thunder Bay.
Baldwin	Sudbury.
Balfour	"
Ballantyne	Nipissing.
Bangor	Hastings.
Banks	Timiskaming.
Bannerman	Algoma.
Bannockburn	Timiskaming.
Barber	"
Barker	Algoma.
Barlow	Thunder Bay.
Barnet	Timiskaming.
Barr	"
Barrie	Frontenac.
Barrie Island	Manitoulin.
Barron	Nipissing.
Bartlett	Timiskaming.
Barton	Wentworth
Barwick	Rainy River.
Bastard	Leeds.
Bastedo	Nipissing.
Bathurst	Lanark.
Baxter	Muskoka.
Bayham	Elgin.
Bayly	Timiskaming.
Beardmore	"
Beaucage	Nipissing.
Beauchamp	Timiskaming.
Beatty	"
Beaumont	Sudbury.
Beck	Timiskaming.
Beckwith	Lanark.
Bedford	Frontenac.
Beemer	Sudbury.
Belfast	Nipissing.
Bell	Thunder Bay.
Belmont	Peterborough.
Bennett	Rainy River.
Ben Nevis	Timiskaming.
Benneweiss	Sudbury.
Benoit	Timiskaming.
Bentinck	Grey.
Beresford	Sudbury.
Bernhardt	Timiskaming.
Berry	Nipissing.
Bertie	Welland.
Bertram	Nipissing.
Bethune	Parry Sound.
Beulah	Sudbury.
Beverly	Wentworth.
Bexely	Victoria.
Bicknell	Algoma.
Biddulph	Middlesex.
Bidwell	Manitoulin

TOWNSHIPS IN ONTARIO—*Continued.*

Township.	County or District.
Bigelow	Sudbury.
Biggar	Nipissing.
Bigwood	Sudbury.
Billings	Manitoulin.
Binbrook	Wentworth.
Bishop	Nipissing.
Bisley	Timiskaming.
Black	"
Blackstock	Nipissing.
Blain	Timiskaming.
Blair	Parry Sound.
Blake	Thunder Bay.
Blandford	Oxford.
Blanchard	Perth.
Blenheim	Oxford.
Blewett	Sudbury
Blezard	"
Blount	Timiskaming.
Blue	Rainy River.
Blyth	Nipissing.
Blithfield	Renfrew.
Bompas	Timiskaming.
Bond	"
Bonfield	Nipissing.
Bonis	Timiskaming.
Booth	Thunder Bay.
Borden	Sudbury.
Bosanquet	Lambton.
Boston	Timiskaming.
Boulter	Nipissing.
Bowell	Sudbury.
Bower	Nipissing.
Bowman	Timiskaming.
Bowyer	"
Boyce	Algoma.
Boyd	Nipissing.
Bradburn	Timiskaming.
Brant	Bruce.
Brantford	Brant.
Brethour	Timiskaming.
Brewster	"
Bridgland	Algoma.
Bright	"
Brighton	Northumberland.
Briggs	Nipissing.
Brigstocke	Timiskaming.
Bristol	"
Britton	Kenora
Brock	Ontario.
Broder	Sudbury.
Bromley	Renfrew.
Bronson	Nipissing.
Brooke	Lambton.
Broughan	Renfrew.
Brower	Timiskaming.
Brown	Parry Sound.
Browning	Sudbury.
Bruce	Bruce
Brudenell	Renfrew.
Brunel	Muskoka.
Brunet	Sudbury.
Brunswick	"
Bruton	Haliburton.
Bryce	Timiskaming.
Buchan	Algoma.
Buchanan	Renfrew.
Bucke	Timiskaming.
Buller	Kenora.
Burford	Brant.
Burgess, North	Lanark.
Burgess, South	Leeds.
Burk	Kenora.
Burleigh	Peterborough.
Burns	Renfrew.
Burpee	Parry Sound.
Burpee	Manitoulin.
Burrell	Algoma.
Burriss	Rainy River.
Burritt	Sudbury.
Burrows	"
Burt	Timiskaming.
Burton	Parry Sound.
Burwash	Sudbury.
Butt	Nipissing.
Byers	Timiskaming.
Byron	Thunder Bay.
Cabot	Sudbury.
Cairo	Timiskaming.
Caistor	Lincoln.
Caithness	Algoma.
Calder	Timiskaming.
Caldwell	Nipissing.
Caledon	Peel.
Caledonia	Prescott.
Calvert	Nipissing.
Calvin	"
Cambridge	Russell.
Camden	Kent.
Camden East	Addington.
Cameron	Nipissing.
Campbell	Manitoulin.
Canborough	Haldimand.
Cane	Timiskaming.
Canisbay	Nipissing.
Canonto, North	Frontenac.
Canonto, South	"
Canton	Nipissing.
Capreol	Sudbury.
Caradoc	Middlesex.
Carden	Victoria.
Cardiff	Haliburton.
Cardwell	Muskoka.
Carling	Parry Sound.
Carlow	Hastings.
Carlyle	Manitoulin.
Carman	Timiskaming.
Carnarvon	Manitoulin.
Carnegie	Timiskaming.
Carney	Algoma.
Carpenter	Rainy River.
Carr	Timiskaming.
Carrick	Bruce.
Carscallen	Timiskaming
Carter	Sudbury.
Cartier	"
Cartwright	Durham.
Cascaden	Sudbury.
Casey	Timiskaming.
Casgrain	Algoma.
Cashel	Hastings.
Casimir	Sudbury.
Cassels	Nipissing.
Catharine	Timiskaming.
Cavan	Durham.
Cavendish	Peterborough.

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TOWNSHIPS IN ONTARIO—*Continued.*

Township.	County or District.
Cayuga, North	Haldimand.
Cayuga, South	"
Chaffey	Muskoka.
Chamberlain	Timiskaming.
Chambers	Nipissing.
Champagne	Sudbury.
Chandos	Peterborough.
Chapleau	Sudbury
Chapman	Parry Sound.
Charlottenburg	Glengarry.
Charlotteville	Norfolk.
Charlton	Nipissing.
Charters	Timiskaming.
Chatham	Kent.
Cherriman	Sudbury.
Chesley	Algoma.
Chenier	Sudbury.
Chewett	"
Childerhose	Timiskaming.
Chinguacousy	Peel.
Chipman	Thunder Bay.
Chisholm	Nipissing.
Chown	Timiskaming.
Christie	Parry Sound.
Churchill	Sudbury.
Clancy	Nipissing.
Clara	Renfrew.
Clarence	Russell.
Clarendon	Frontenac.
Clarke	Durham.
Clary	Sudbury.
Clavet	Algoma.
Cleaver	Timiskaming.
Cleland	Sudbury.
Clement	"
Clergue	Timiskaming
Clifford	"
Clinton	Lincoln.
Clouston	Algoma.
Clute	Timiskaming
Clyde	Haliburton.
Cobden	Algoma.
Cochrane	Sudbury.
Cockburn Island	Manitoulin.
Coderre	Algoma.
Cody	Timiskaming.
Colborne	Huron.
Colchester, North	Essex.
Colchester, South	"
Cole	Timiskaming.
Coleman	"
Colenso	Kenora.
Collingwood	Grey.
Collins	Sudbury.
Colquhoun	Timiskaming.
Commanda	Nipissing.
Conger	Parry Sound.
Conmee	Thunder Bay.
Connaught	Sudbury.
Cook	Timiskaming.
Corkill	"
Corley	"
Cornwall	Stormont.
Cosby	Sudbury.
Coté	Timiskaming.
Cotton	Sudbury.
Coulson	Timiskaming
Cox	Sudbury.
Craig	"
Cramahe	Northumberland.
Crawford	Timiskaming.
Creelman	Sudbury.
Creighton	"
Crerar	Nipissing.
Croft	Parry Sound.
Crooks	Thunder Bay.
Crosby, North	Leeds.
Crosby, South	"
Crothers	Sudbury.
Crowland	Welland.
Crozier	Rainy River.
Culross	Bruce.
Cumberland	Russell.
Curran	Rainy River.
Currie	Timiskaming.
Curtis	Algoma.
Dack	Timiskaming.
Dalhousie	Lanark.
Dalton	Victoria.
Dana	Nipissing.
Dance	Rainy River.
Dane	Timiskaming.
D'Arcy	Sudbury.
Dargavel	Timiskaming.
Darling	Lanark.
Darlington	Durham.
Davidson	Timiskaming.
Davin	Algoma.
Davis	Sudbury.
Dawn	Lambton.
Dawson	Manitoulin.
Day	Algoma.
Deacon	Nipissing.
Delamere	Sudbury.
Delaware	Middlesex.
Delhi	Sudbury.
Deloro	Timiskaming.
De Morest	Sudbury.
Denbigh	Addington.
Denison	Sudbury.
Dennis	Algoma.
Denton	Timiskaming.
Derby	Grey.
Dereham	Oxford.
Deroche	Algoma.
Devine	Nipissing.
Devitt	Algoma.
Devlin	Rainy River.
Dewart	"
Dickens	Nipissing.
Dickson	"
Digby	Victoria.
Dilke	Rainy River.
Dill	Sudbury.
Dobie	Rainy River.
Doherty	Algoma.
Dokis	Timiskaming.
Donovan	"
Doon	"
Dorchester, North	Middlesex.
Dorchester, South	Elgin.
Dorion	Thunder Bay.
Douglas	Timiskaming.
Douro	Peterborough.

TOWNSHIPS IN ONTARIO—*Continued.*

Township.	County or District.
Dover, East	Kent.
Dover, West	"
Dowling	Sudbury.
Downie	Perth.
Doyle	Timiskaming.
Draper	Muskoka.
Drayton	Sudbury.
Drummond	Lanark.
Drury	Sudbury.
Dryden	"
Dudley	Haliburton.
Duff	Timiskaming.
Dufferin	"
Dumfries, North	Waterloo.
Dumfries, South	Brant.
Dummer	Peterborough.
Dunbar	Sudbury.
Duncan	Algoma.
Dundee	Sudbury.
Dundonald	Timiskaming.
Dungannon	Hastings.
Dunlop	Sudbury.
Dunmore	Timiskaming.
Dunn	Haldimand.
Dunnet	Sudbury.
Dunwich	Elgin.
Dymond	Timiskaming.
Dysart	Haliburton.
Easthope, North	Perth.
Easthope, South	"
Eastnor	Bruce.
Ebbs	Algoma.
Eby	Timiskaming.
Eddy	Nipissing.
Edgar	"
Edwards	Timiskaming.
Edwardsburgh	Grenville.
Effingham	Addington.
Egan	Timiskaming.
Egremont	Grey.
Eilber	Algoma.
Ekfrid	Middlesex.
Elderslie	Bruce.
Eldon	Victoria.
Eldorado	Timiskaming.
Elizabethtown	Leeds.
Ellice	Perth.
Elliott	Timiskaming.
Ellis	Sudbury.
Elma	Perth.
Elmsley, North	Lanark.
Elmsley, South	Leeds.
Elzevir	Hastings.
Emerald	Sudbury.
Emily	Victoria.
English	Sudbury.
Ennisikillen	Lambton.
Ennismore	Peterborough.
Eramosa	Wellington.
Erin	"
Ermatinger	Sudbury.
Ernestown	Lennox.
Escott	Leeds.
Esquesing	Halton.
Essa	Simcoe.
Esten	Algoma.
Etobicoke	York.
Eton	Kenora.

Township.	County or District.
Euphemia	Lambton.
Euphrasia	Grey.
Evanturel	Timiskaming.
Evelyn	"
Eyre	Haliburton.
Fairbairn	Sudbury.
Fairbank	"
Falconbridge	"
Falconer	Nipissing.
Fallon	Timiskaming.
Faraday	Hastings.
Farr	Timiskaming.
Farrington	Rainy River.
Fasken	Timiskaming.
Fauquier	"
Fawcett	Sudbury.
Fell	Nipissing.
Fenelon	Victoria.
Fenwick	Algoma.
Ferguson	Parry Sound.
Fernow	Thunder Bay.
Ferrie	Parry Sound.
Ferris	Nipissing.
Field	"
Finch	Stormont.
Findlay	Timiskaming.
Finlayson	Nipissing.
Fintry	Algoma.
Firstbrook	Timiskaming.
Fisher	Algoma.
Fitzgerald	Nipissing.
Fitzroy	Carleton.
Flamborough, East	Wentworth.
Flamborough, West	"
Flavelle	Timiskaming.
Fleck	Algoma.
Fleming	Rainy River.
Flos	Simcoe.
Foley	Parry Sound.
Foster	Sudbury.
Fournier	Timiskaming.
Fox	Nipissing.
Foy	Sudbury.
Fraleck	"
Fraleigh	Thunder Bay.
Franklin	Muskoka.
Franz	Algoma.
Fraser	Renfrew.
Frechette	Sudbury.
Fredericksburgh, North	Lennox.
Fredericksburgh, South	"
Freeman	Muskoka.
French	Nipissing.
Freswick	"
Fripp	Timiskaming.
Fullarton	Perth.
Fushimi	Algoma.
Gainsborough	Lincoln.
Galbraith	Algoma.
Gallagher	Sudbury.
Galna	Timiskaming.
Galway	Peterborough.
Gamble	Timiskaming.
Gamey	Sudbury.
Garafraxa, East	Dufferin.
Garafraxa, West	Wellington.
Garrow	Nipissing.
Garson	Sudbury.
Garvey	"

TOWNSHIPS IN ONTARIO—*Continued.*

Township.	County or District.
Gaudette	Algoma.
Gauthier	Timiskaming
Geary	"
Geikie	"
Georgina	York.
German	Timiskaming
Gibbons	Nipissing.
Gibson	Muskoka.
Gill	Algoma.
Gillies	Thunder Bay.
Gillmor	Algoma.
Glackmeyer	Timiskaming
Gladman	Nipissing.
Gladstone	Algoma.
Glamorgan	Haliburton.
Glanford	Wentworth.
Glenelg	Grey.
Gloucester	Carleton.
Goderich	Huron.
Godfrey	Timiskaming.
Gooderham	Nipissing.
Goodwin	Thunder Bay.
Gordon	Manitoulin.
Gorham	Thunder Bay.
Goschen	Sudbury.
Gosfield, North	Essex.
Gosfield, South	"
Gough	Sudbury.
Gouin	"
Goulbourn	Carleton.
Gould	Algoma.
Gowan	Timiskaming.
Gower, North	Carleton.
Gower, South	Grenville.
Graham	Sudbury.
Grant	Nipissing.
Grantham	Lincoln.
Grasett	Algoma.
Grattan	Renfrew.
Greenock	Bruce.
Grenfell	Timiskaming.
Grey	Huron.
Griffith	Renfrew.
Grigg	Sudbury.
Grimsby, North	Lincoln.
Grimsby, South	"
Grimsthorpe	Hastings.
Gross	Timiskaming.
Groves	Sudbury.
Guelph	Wellington.
Guibord	Timiskaming.
Guilford	Haliburton.
Gurd	Parry Sound.
Gurney	Timiskaming.
Guthrie	Nipissing.
Gwillimbury, North	York.
Gwillimbury, East	"
Gwillimbury, West	Simcoe.
Haddo	Sudbury.
Haentschel	"
Hagar	"
Hagarty	Renfrew.
Hagerman	Parry Sound.
Haggart	Timiskaming.
Haldimand	Northumberland.
Halkirk	Rainy River.
Hallam	Sudbury.
Halliday	Sudbury.
Hallowell	Prince Edward.
Hamilton	Northumberland.
Hammell	Nipissing.
Hanlon	Algoma.
Hanmer	Sudbury.
Hanna	Timiskaming.
Harburn	Haliburton.
Harcourt	"
Hardiman	Sudbury.
Hardy	Parry Sound.
Harley	Timiskaming.
Harris	"
Harrison	Parry Sound
Harrow	Sudbury.
Hart	"
Hartman	Kenora.
Harty	Sudbury.
Harvey	Peterborough.
Harwich	Kent.
Hassard	Sudbury.
Haughton	Algoma.
Haultain	Timiskaming.
Havelock	Haliburton.
Havilland	Algoma.
Hawkesbury, East	Prescott.
Hawkesbury, West	"
Hawkins	Algoma.
Hawley	Sudbury.
Hay	Huron.
Haycock	Kenora.
Hayward	Algoma.
Hazen	Sudbury.
Head	Renfrew.
Hearst	Timiskaming.
Henderson	Thunder Bay.
Hendrie	Sudbury.
Hennessy	"
Henry	"
Henwood	Timiskaming.
Herrick	Algoma.
Herschell	Hastings.
Hess	Sudbury.
Hibbert	Perth.
Hillary	Timiskaming.
Hilliard	"
Hillier	Prince Edward.
Hilton	Algoma.
Himsworth, North	Parry Sound.
Himsworth, South	"
Hinchinbrooke	Frontenac.
Hincks	Timiskaming.
Hindon	Haliburton.
Hislop	Timiskaming.
Hobbs	Nipissing.
Hodgetts	Sudbury.
Hodgins	Algoma.
Hogarth	Thunder Bay.
Holland	Grey.
Holmes	Timiskaming.
Homer	Thunder Bay
Hope	Durham.
Horton	Renfrew.
Hoskin	Sudbury.
Houghton	Norfolk.
Howard	Kent.
Howe Island	Frontenac.

TOWNSHIPS IN ONTARIO—*Continued.*

Township.	County or District.
Howey	Sudbury.
Howick	Huron.
Howland	Manitoulin.
Hoyle	Timiskaming.
Hudson	"
Hugel	Nipissing.
Hullett	Huron.
Humberstone	Welland.
Humboldt	Manitoulin.
Humphrey	Parry Sound.
Hungerford	Hastings.
Hunter	Nipissing.
Huntingdon	Hastings.
Huntley	Carleton.
Huron	Bruce.
Hutt	Sudbury.
Hutton	"
Hyman	"
Idington	Algoma.
Ingram	Timiskaming.
Innes	Thunder Bay.
Innisfil	Simcoe.
Irving	Algoma.
Ivanhoe	Sudbury.
Jack	"
Jaffray	Kenora.
James	Timiskaming.
Jamieson	"
Janes	Sudbury.
Jarvis	Algoma.
Jessop	Timiskaming.
Jennings	Sudbury.
Jocelyn	Algoma.
Johnson	"
Joly	Parry Sound.
Jones	Renfrew.
Kaladar	Lennox.
Kapuskasing	Algoma.
Kars	"
Katrine	Timiskaming.
Keefer	"
Keely	Nipissing.
Kehoe	Algoma.
Keith	Sudbury.
Kelly	"
Kelvin	"
Kemp	"
Kendall	Algoma.
Kendrey	Timiskaming.
Kennebec	Frontenac.
Kennedy	Timiskaming.
Kenny	Nipissing.
Kenyon	Glengarry.
Keppel	Grey.
Kerns	Timiskaming.
Kerrs	"
Kimberley	"
Kincaid	Algoma.
Kincardine	Bruce.
Kidd	Timiskaming.
King	York.
Kingsford	Rainy River.
Kingsmill	Timiskaming.
Kingston	Frontenac.
Kinloss	Bruce.
Kirkland	Timiskaming.
Kirkpatrick	Nipissing
Kirkwall	Algoma.
Kirkwood	Algoma.
Kitchener	Sudbury.
Kitley	Leeds.
Kittson	Timiskaming.
Klock	"
Klotz	Thunder Bay.
Knight	Timiskaming.
Knox	"
Kohler	Algoma.
Korah	"
Lackner	Sudbury.
Ladysmith	Kenora.
Laidlaw	Algoma.
Laird	"
Lake	Hastings.
Lamarche	Timiskaming.
Lampman	Sudbury.
Lanark	Lanark.
Lancaster	Glengarry.
Landry	Algoma.
Langmuir	Timiskaming.
Langton	Kenora.
Lansdowne	Leeds.
Lash	Rainy River.
Latchford	Nipissing.
Lauder	"
Laura	Sudbury.
Laurier	Parry Sound.
Lavant	Lanark.
Law	Nipissing.
Lawrence	Haliburton.
Lawson	Timiskaming.
Laxton	Victoria.
Leask	Sudbury.
Lebel	Timiskaming.
Leckie	"
Ledger	Thunder Bay.
Lee	Timiskaming.
Leeds	Leeds.
Lefroy	Algoma.
Legge	"
Leitch	Timiskaming.
Leith	"
Lennox	"
Leo	"
Leonard	"
LeRoche	Nipissing.
Lerwick	Algoma.
Levack	Sudbury.
Lewis	Algoma.
Ley	"
Limerick	Hastings.
Lindsay	Bruce.
Lister	Nipissing.
Little	Timiskaming.
Livingstone	Haliburton.
Lobo	Middlesex.
Lochiel	Glengarry.
Lockhart	Nipissing.
Logan	Perth.
London	Middlesex.
Londonderry	Sudbury.
Long	Algoma.
Longford	Victoria.
Longueuil	Prescott.
Lorne	Sudbury.
Lorrain	Timiskaming.
Loudon	Nipissing.
Loughborough	Frontenac.

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TOWNSHIPS IN ONTARIO—*Continued.*

Township.	County or District.
Lougheed	Algoma.
Loughrin	Sudbury.
Louise	"
Lount	Parry Sound.
Louth	Lincoln.
Louther	Algoma.
Loveland	Timiskaming.
Low	Thunder Bay.
Lucas	Timiskaming.
Lumsden	Sudbury.
Lundy	Timiskaming.
Luther, East	Dufferin.
Luther, West	Wellington.
Lutterworth	Haliburton.
Lybster	Thunder Bay.
Lyell	Nipissing.
Lyman	"
Lyndoch	Renfrew.
Lyon	Thunder Bay.
Mabee	Timiskaming.
McArthur	"
McBride	Sudbury.
McCallum	Nipissing.
McCann	Timiskaming.
McCart	"
McCarthy	Sudbury.
McCaul	Rainy River.
M'Clintock	Haliburton.
M'Clure	Hastings.
McCoig	Algoma.
McConkey	Parry Sound.
McConnell	Sudbury.
McCool	Timiskaming.
McCrae	Algoma.
McCraney	Nipissing.
McCrosson	Rainy River
McDougall	Parry Sound.
McElroy	Timiskaming.
McEvay	"
McFadden	"
McGarry	"
McGee	Sudbury.
McGiffin	Timiskaming.
McGillivray	Middlesex.
McGiverin	Algoma.
McGowan	"
McGregor	Thunder Bay.
McIntyre	"
McIrvine	Rainy River.
McKay	Renfrew.
McKellar	Parry Sound.
McKeown	Sudbury.
McKillop	Huron.
McKim	Sudbury.
McLaren	Nipissing.
McLaughlin	"
McLean	Muskoka.
McLeod	Sudbury.
McMahon	Algoma.
McMillan	"
McMurchy	Sudbury.
McMurrich	Parry Sound.
McNab	Renfrew.
McNamara	Sudbury.
McNaught	"
McNeil	Timiskaming.
McNish	Sudbury.
McTavish	Thunder Bay.
McVittie	Timiskaming.
McWilliams	Nipissing.
Macaulay	Muskoka.
Macbeth	Sudbury.
Macdonald	Algoma.
Macdiarmid	Timiskaming.
Machar	Parry Sound.
Machin	Timiskaming.
Mack	Algoma.
Mackelcan	Sudbury.
Mackenzie	Parry Sound.
Mackinnon	Sudbury.
Macklem	Timiskaming.
Maclennan	Sudbury.
Macpherson	Nipissing.
Madoc	Hastings.
Mafeking	Kenora.
Mahaffy	Timiskaming.
Maidstone	Essex.
Maisonville	Timiskaming.
Malachi	Kenora.
Malahide	Elgin.
Malden	Essex.
Mann	Timiskaming.
Manvers	Durham.
Mara	Ontario.
Marathon	Timiskaming.
March	Carleton.
Marconi	Sudbury.
Maria	Renfrew.
Mariposa	Victoria.
Markham	York.
Marks	Thunder Bay
Marlborough	Carleton.
Marmora	Hastings.
Marquis	Timiskaming
Marshay	Sudbury.
Marter	Nipissing.
Martin	Algoma.
Martland	Sudbury.
Maryborough	Wellington.
Marysburgh, North	Prince-Edward.
Marysburgh, South	Prince Edward
Mason	Sudbury.
Massey	Timiskaming.
Master	Nipissing.
Matawatchan	Renfrew.
Matchedash	Simcoe.
Mather	Rainy River.
Matheson	Timiskaming.
Mathieu	Rainy River.
Matilda	Dundas.
Mattagami	Sudbury.
Mattawan	Nipissing.
May	Sudbury.
Mayo	Hastings.
Medina	Timiskaming.
Medonte	Simcoe.
Medora	Muskoka.
Melancthon	Dufferin.
Melba	Timiskaming.
Melick	Kenora.
Melgund	"
Meredith	Algoma.
Merick	Nipissing.
Merritt	Sudbury.
Mersea	Essex.
Metcalfe	Middlesex.
Methuen	Peterborough

TOWNSHIPS IN ONTARIO—*Continued.*

Township.	County or District.
Michand	Timiskaming.
Michie	"
Mickle	"
Middleboro	Sudbury.
Middleton	Norfolk.
Midlothian	Timiskaming.
Miller	Frontenac.
Milligan	Timiskaming.
Mills	Parry Sound.
Mills	Manitoulin.
Milne	Nipissing.
Milner	Timiskaming.
Minden	Haliburton.
Minto	Wellington.
Miramichi	Sudbury.
Miscampbell	Rainy River.
Moberly	Timiskaming.
Moher	Sudbury.
Monaghan, North	Peterborough.
Monaghan, South	Northumberland.
Monck	Muskoka.
Moncrieff	Sudbury.
Mond	"
Monmouth	Haliburton.
Mono	Dufferin.
Montague	Lanark.
Monteagle	Hastings.
Monteith	Parry Sound.
Montgomery	Algoma.
Montrose	Timiskaming.
Moody	"
Moore	Lambton.
Moorehouse	Sudbury.
Morel	Timiskaming.
Morgan	Sudbury.
Morin	Algoma.
Morley	Rainy River.
Mornington	Perth.
Morris	Huron.
Morrisette	Timiskaming.
Morrison	Muskoka.
Morson	Rainy River.
Mortimer	Timiskaming.
Mosa	Middlesex.
Moss	Thunder Bay.
Moulton	Haldimand.
Mountain	Dundas.
Mountjoy	Timiskaming.
Mowat	Parry Sound.
Mulligan	Timiskaming.
Mulloy	Algoma.
Mulmer	Dufferin.
Mulock	Nipissing.
Mulvey	Algoma.
Munro	Timiskaming.
Murchison	Nipissing.
Murphy	Timiskaming.
Murray	Northumberland.
Musgrove	Timiskaming.
Muskego	Sudbury.
Muskoka	Muskoka.
Mutrie	Kenora.
Nairn	Sudbury.
Nansen	Timiskaming.
Nassagaweya	Halton.
Natal	Sudbury.
Neebing	Thunder Bay.
Neelon	Sudbury.
Neely	Algoma.
Nelles	Rainy River.
Nelson	Halton.
Nepean	Carleton.
Nesbitt	Timiskaming.
Newmarket	"
Niagara	Lincoln.
Nichol	Wellington.
Nicol	Timiskaming.
Nightingale	Haliburton.
Nipigon	Thunder Bay.
Nipissing	Parry Sound.
Nissouri, East	Oxford.
Nissouri, West	Middlesex.
Niven	Nipissing.
Nixon	Timiskaming.
Noble	Sudbury.
Nordica	Timiskaming.
Norman	Sudbury.
Normanby	Grey.
Northrup	Sudbury.
Norwich, North	Oxford.
Norwich, South	"
Notman	Nipissing.
Nottawasaga	Simcoe.
Nursey	Sudbury.
Oakland	Brant.
Oakley	Muskoka.
Oates	Sudbury.
O'Brien	Timiskaming.
O'Connor	Thunder Bay.
Ogden	Timiskaming.
Ogilvie	Sudbury.
Olden	Frontenac.
Olive	Nipissing.
Oliver	Thunder Bay.
Olrig	Nipissing.
O'Meara	Thunder Bay.
Onaping	Sudbury.
Oneida	Haldimand.
Onondaga	Brant.
Ops	Victoria.
Orford	Kent.
Orillia, North	Simcoe.
Orillia, South	"
Orkney	Algoma.
Oro	Simcoe.
Osborne	Nipissing.
Osgoode	Carleton.
Osler	Nipissing.
Osnabruck	Stormont.
Oso	Frontenac.
Ossian	Timiskaming.
Osprey	Grey.
Otonabee	Peterborough.
Ottaway	Timiskaming.
Otter	Algoma.
Otto	Timiskaming.
Owens	"
Oxford	Grenville.
Oxford, North	Oxford.
Oxford, East	"
Oxford, West	"
Pacaud	Timiskaming.
Paipoonge	Thunder Bay.
Pakenham	Lanark.
Palmer	Algoma.

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TOWNSHIPS IN ONTARIO—*Continued.*

Township.	County or District.
Palmerston	Frontenac.
Papineau	Nipissing.
Pardee	Thunder Bay.
Pardo	Nipissing.
Parke	Algoma.
Parker	Sudbury.
Parkin	"
Parkinson	Algoma.
Patterson	Parry Sound.
Pattinson	Sudbury.
Patton	Algoma.
Pattullo	Rainy River.
Paul	Sudbury.
Paxton	Nipissing.
Pearce	Timiskaming.
Pearson	Thunder Bay.
Peck	Nipissing.
Peel	Wellington.
Pedley	Nipissing.
Pelham	Welland.
Pelican	Kenora.
Pellatt	"
Pelletier	Algoma.
Pembroke	Renfrew.
Penharwood	Sudbury.
Pennefather	Algoma.
Pense	Timiskaming.
Pentland	Nipissing.
Percy	Northumberland.
Perry	Parry Sound.
Petawawa	Renfrew.
Pettypiece	Kenora.
Pharand	Timiskaming.
Phelps	Nipissing.
Pic	Thunder Bay.
Pickering	Ontario.
Pilkington	Wellington.
Pittsburgh	Frontenac.
Plantagenet, North	Prescott.
Plantagenet, South	"
Playfair	Timiskaming.
Plummer	Algoma.
Plympton	Lambton.
Poitras	Nipissing.
Pontiac	Timiskaming.
Porter	Sudbury.
Portland	Frontenac.
Potts	Rainy River.
Powell	Timiskaming.
Pratt	Rainy River.
Preston	Nipissing.
Price	Timiskaming.
Prince	Algoma.
Pringle	Parry Sound.
Proctor	Algoma.
Prosser	Timiskaming.
Proton	Grey.
Proudfoot	Parry Sound.
Purdom	Thunder Bay.
Purvis	Nipissing.
Puslinch	Wellington.
Pyne	Timiskaming.
Radcliffe	Renfrew.
Raglan	"
Rainham	Haldimand.
Raleigh	Kent.
Rama	Ontario.
Ramsay	Sudbury.
Ramsay	Lanark.
Ramsay Wright	Rainy River.
Rankin	Timiskaming.
Rathbun	Sudbury.
Ratter	"
Rattray	Timiskaming.
Rawdon	Hastings.
Ray	Timiskaming.
Raymond	"
Raynar	Thunder Bay.
Rayside	Sudbury.
Reach	Ontario.
Reaume	Timiskaming.
Redditt	Kenora.
Redvers	"
Regan	Sudbury.
Reid	Timiskaming.
Revell	Kenora.
Reynolds	Timiskaming.
Rice	Kenora.
Richards	Renfrew.
Richardson	Rainy River.
Richmond	Lennox.
Rickard	Timiskaming.
Riddell	Nipissing.
Ridout	Muskoka.
Ritchie	Algoma.
Roadhouse	Timiskaming.
Roberts	Sudbury.
Robertson	Timiskaming.
Robinson	Manitoulin.
Robillard	Timiskaming
Robb	"
Roblin	Sudbury.
Roche	Algoma.
Rochester	Essex.
Roddick	Rainy River.
Rogers	Algoma.
Rolph	Renfrew.
Romney	Kent.
Rorke	Timiskaming.
Rose	Algoma.
Rosebery	Rainy River
Ross	Renfrew.
Rowell	Kenora.
Roxborough	Stormont.
Rugby	Kenora.
Russell	Russell.
Rutherford	Manitoulin.
Ryan	Algoma.
Ryde	Muskoka.
Ryerson	Parry Sound.
Sabine	Nipissing.
St. Edmunds	Bruce.
St. John	Timiskaming.
St. Joseph	Algoma.
St. Louis	Sudbury.
St. Mary	Algoma.
St. Vincent	Grey.
Salter	Sudbury.
Saltfleet	Wentworth.
Sandfield	Manitoulin.
Sandwich, East	Essex.
Sandwich, West	"
Sandwich, South	"
Sandford	Kenora.
Sankey	Algoma.

TOWNSHIPS IN ONTARIO—*Continued.*

Township.	County or District.
Sarawak	Grey.
Sargeant	Timiskaming.
Sarnia	Lambton.
Saugeen	Bruce.
Savard	Timiskaming.
Scadding	Sudbury.
Scarborough	York.
Scarfe	Algoma.
Scholes	Nipissing.
Scoble	Thunder Bay
Scholfield	Algoma.
Scollard	Sudbury.
Scotia	"
Scott	Ontario.
Scugog	"
Seagram	Sudbury.
Sebastopol	Renfrew.
Secord	Sudbury.
Selby	"
Selkirk	"
Selwyn	Thunder Bay.
Semple	Sudbury.
Seneca	Haldimand.
Servos	Sudbury.
Seymour	Northumberland.
Shackleton	Timiskaming.
Shakespeare	Sudbury.
Shannon	Algoma.
Sharpe	Timiskaming.
Shaw	Sudbury.
Shawanaga	Parry Sound.
Sheard	Sudbury.
Sheba	Timiskaming.
Shedden	Algoma.
Sheffield	Addington.
Sheguiandah	Manitoulin.
Shelburne	Sudbury.
Shelley	"
Shenango	"
Shenstone	Rainy River.
Sheppard	Sudbury.
Sheraton	Timiskaming.
Sherborne	Haliburton.
Sherbrooke	Haldimand.
Sherbrooke, North	Lanark.
Sherbrooke, South	"
Sherring	Timiskaming.
Sherwood	Renfrew.
Shetland	Algoma.
Shields	"
Shillington	Timiskaming.
Shuel	Algoma.
Sibley	Thunder Bay.
Sidney	Hastings.
Sifton	Rainy River.
Simpson	Algoma.
Sisk	Nipissing.
Sinclair	Muskoka.
Skead	Timiskaming.
Sladen	Sudbury.
Smellie	Kenora.
Smith	Peterborough.
Smyth	Timiskaming.
Snider	Sudbury.
Snowdon	Haliburton.
Sombra	Lambton.
Somerville	Victoria.
Sophiasburg	Prince Edward.
Sothman	Sudbury.
South Lorrain	Timiskaming.
Southwold	Elgin.
Southworth	Kenora.
Speight	Timiskaming.
Spence	Parry Sound.
Spohn	Rainy River.
Spragge	Algoma.
Springer	Nipissing.
Sproule	"
Stafford	Renfrew.
Stamford	Welland.
Stanhope	Haliburton.
Stanley	Huron.
Staunton	Algoma.
Steele	Timiskaming.
Stefaunson	Algoma.
Stephen	Huron.
Stetham	Sudbury.
Stephenson	Muskoka.
Stewart	Nipissing.
Stimson	Timiskaming.
Stirling	Thunder Bay.
Stisted	Muskoka.
Stobie	Sudbury.
Stock	Timiskaming.
Stoddard	Algoma.
Storrington	Frontenac.
Strange	Thunder Bay.
Strathcona	Nipissing.
Strathearn	Sudbury.
Strathy	Nipissing.
Stratton	"
Street	Sudbury.
Striker	Algoma.
Strong	Parry Sound.
Studholme	Algoma.
Stull	Sudbury.
Sullivan	Grey.
Sulman	Timiskaming.
Sunnidale	Simcoe.
Sutherland	Rainy River.
Swanson	Timiskaming.
Sweatman	"
Sweeny	Sudbury.
Sydenham	Grey.
Sydere	Timiskaming.
Tait	Rainy River.
Talbot	Algoma.
Tannahill	Timiskaming.
Tarbutt	Algoma.
Tarentorus	"
Tay	Simcoe.
Taylor	Timiskaming
Teck	"
Tecumseth	Simcoe.
Teefy	Timiskaming.
Teetzel	"
Tehkummah	Manitoulin.
Telfer	Sudbury.
Temple	Kenora.
Templeton	Algoma.
Tennyson	"
Terry	Timiskaming.
Thackeray	"
Thessalon	Algoma.
Thistle	Nipissing.
Thomas	Timiskaming.
Thompson	Algoma.

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TOWNSHIPS IN ONTARIO—*Concluded.*

Township.	County or District.
Thorah	Ontario.
Thorburn	Timiskaming.
Thorneloe	"
Thorold	Welland.
Thurlow	Hastings.
Tilbury, North	Essex.
Tilbury, East	Kent.
Tilbury, West	Essex.
Tilley	Algoma.
Tilton	Sudbury.
Timmins	Timiskaming.
Tiny	Simcoe.
Tisdale	Timiskaming.
Togo	Sudbury.
Tolstoi	Timiskaming.
Torbolton	Carleton.
Toronto	Peel.
Toronto Gore	"
Torrance	Sudbury.
Torrington	Nipissing.
Tosorontio	Simcoe.
Totten	Sudbury.
Tovell	Rainy River.
Townsend	Norfolk.
Trafalgar	Halton.
Trethewey	Timiskaming.
Trill	Sudbury.
Truax	Timiskaming
Tucker	Sudbury.
Tuckersmith	Huron.
Tudhope	Timiskaming.
Tudor	Hastings.
Tully	Timiskaming.
Tupper	Algoma.
Turnberry	Huron.
Turnbull	Timiskaming.
Turner	Sudbury.
Tuscarora	Brant.
Tyendinaga	Hastings.
Tyrrell	Timiskaming.
Umbach	Kenora.
Unwin	Sudbury.
Usborne	Huron.
Uxbridge	Ontario.
Valin	Sudbury.
Van Horne	Kenora.
Van Nostrand	Timiskaming.
Van Hise	"
Vankoughnet	Algoma.
Vaughan	York.
Vernon	Sudbury.
Verulam	Victoria.
Vespra	Simcoe.
Victoria	Algoma.
Vogt	Nipissing.
Vrooman	Sudbury.
Wabigoon	Kenora.
Wainfleet	Welland.
Wainwright	Kenora.
Waldie	Sudbury.
Walker	Timiskaming.
Wallace	Perth.
Wallbridge	Parry Sound.
Wallis	Timiskaming.
Walpole	Haldimand.
Walsingham, North	Norfolk.
Walsingham, South	"
Warden	Timiskaming.
Ware	Thunder Bay
Wark	Timiskaming.
Warwick	Lambton.
Waterloo	Waterloo.
Waters	Sudbury.
Watt	Muskoka.
Watten	Rainy River.
Wauchope	Kenora.
Wawanosh, East	Huron.
Wawanosh, West	"
Way	Algoma.
Wellesley	Waterloo.
Wells	Algoma.
Wesley	Timiskaming
Westbrook	Sudbury.
Whalen	"
Westmeath	Renfrew.
Westminster	Middlesex.
Whitby	Ontario.
Whitby, East	"
Whitchurch	York.
White	Nipissing.
Whitesides	Timiskaming.
Whitman	Algoma.
Whitney	Timiskaming.
Whitson	"
Wicklow	Hastings.
Widdifield	Nipissing.
Wigle	Sudbury.
Wilberforce	Renfrew.
Wilhelmina	Timiskaming
Wilkes	Nipissing.
Wilkie	Timiskaming.
Willet	"
Williams, North	"
Williams, East	Middlesex.
Williams, West	"
Williamsburgh	Dundas.
Williamson	Timiskaming.
Willison	"
Willoughby	Welland.
Wilmot	Waterloo.
Wilson	Parry Sound.
Winchester	Dundas.
Windham	Norfolk.
Wisner	Sudbury.
Wolfe Island	Frontenac.
Wolford	Grenville.
Wollaston	Hastings.
Wood	Muskoka.
Woodhouse	Norfolk.
Woodyatt	Rainy River.
Woolrich	Algoma.
Woolwich	Waterloo.
Worthington	Rainy River.
Wylie	Renfrew.
Wyse	Nipissing.
Yarmouth	Elgin.
Yarrow	Timiskaming.
Yates	Nipissing.
Yonge	Leeds.
York	York.
Zavitz	Sudbury.
Zealand	Kenora.
Zone	Kent.
Zora, East	Oxford.
Zora, West	"

TOWNSHIPS IN QUEBEC.

Township.	County or District.
Abercrombie	Terrebonne.
Aberdeen	Pontiac.
Aberford	Pontiac and Timiskaming.
Achintre	Champlain and St. Maurice.
Acton	Bagot.
Acton (Gore)	"
Adams	Champlain.
Addington	Labelle.
Adhémar	Pontiac.
Adstock	Frontenac.
Aiguebelle	Timiskaming.
Albanel	Lake St. John.
Albani	Champlain.
Albert	Saguenay.
Aldfield	Pontiac.
Allard	St. Maurice.
Alleyn	Pontiac.
Allumettes	"
Alton	Portneuf.
Amherst	Labelle and Terrebonne.
Amyot	Champlain.
Angers	Bonaventure.
Angoulême	Maskinongé.
Arago	L'Islet.
Archambault	Montcalm.
Armagh	Bellechasse and Montmagny.
Armand	Témiscouata.
Arnaud	Saguenay.
Arthabaska	Arthabaska and Megantic.
Arundel	Argenteuil.
Ascot	Sherbrooke.
Ashburton	Montmagny.
Ashford	L'Islet.
Ashford, Augm	"
Ashuapmouchuan	Lake St. John.
Assemetquagan	Bonaventure.
Aston	Nicolet.
Aston Gore	"
Atwater	Timiskaming.
Aubin	Champlain.
Auckland	Compton.
Auclair	Témiscouata.
Auger	Pontiac.
Aumond	Ottawa.
Awantjish	Matane.
Awantjish, Aug	"
Aylmer	Frontenac.
Aylwin	Ottawa.
Babel	Saguénay.
Baby	Timiskaming.
Bagot	Chicoutimi.
Baillargé	Lake St. John.
Baillargeon	Gaspe.
Bardy	Champlain.
Barford	Stanstead.
Baril	Champlain.
Barnston	Stanstead.
Barraute	Timiskaming.
Barry	Pontiac.
Bartouille	Timiskaming.
Baskatong	Ottawa.
Basserode	Timiskaming.

Township.	County or District.
Baudin	Pontiac and Berthier.
Baune	Saguenay.
Bauneville	Timiskaming.
Bazin	Champlain and St. Maurice.
Béarn	Timiskaming.
Beaubien	L'Islet.
Beaumesnil	Pontiac.
Bédard	Rimouski.
Bégin	Chicoutimi.
Bégon	Témiscouata.
Bellecourt	Saguenay.
Belleau	St. Maurice.
Bellechasse	Bellechasse.
Bellecombe	Timiskaming.
Béraud	"
Beresford	Terrebonne
Bergeronnes	Saguenay.
Bernetz	Timiskaming.
Bernier	Pontiac.
Berlinguet	Champlain and Lake St. John.
Berry	Timiskaming.
Bersimis	Saguenay.
Berthelot	Pontiac.
Biart	Quebec.
Bickerdike	"
Biencourt	Rimouski.
Bigelow	Labelle.
Bisaillon	Champlain.
Bissot	Saguenay.
Blaiklock	Abitibi.
Blais	Matane.
Blake	Labelle and Ottawa.
Blanche	Saguenay.
Blanchet	Gaspe.
Blanc-Sablon (archipelago)	Saguenay.
Blandford	Arthabaska and Nicolet.
Boilleau	Chicoutimi.
Bois	Portneuf.
Boischatel	Timiskaming.
Boisclair	"
Boishébert	Saguenay.
Boisseau	Pontiac.
Bolton	Brome.
Bongard	Pontiac.
Bonin	Champlain and Lake St. John.
Bonne-Espérance	Saguenay.
Booth	Timiskaming.
Borgia	Quebec.
Botsford	Témiscouata.
Boucher	Champlain.
Bouchette	Ottawa.
Bougainville	Saguenay.
Bourassa	Champlain.
Bourdages	Montmagny.
Bourdon	Saguenay.
Bourgeois	Champlain.
Bourget	Chicoutimi.
Bourlamaque	Timiskaming.
Bourmont	Berthier and Pontiac.
Bousquet	Timiskaming.
Bouthillier	Labelle.

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TOWNSHIPS IN QUEBEC—*Continued.*

Township.	County or District.
Bowman	Labelle.
Boyer	"
Brandon	Berthier and Joliette.
Brassard	Berthier.
Brassier	Pontiac.
Brébeuf	Chicoutimi.
Brecourt	Pontiac and St. Maurice.
Brest	Saguenay
Bristol	Pontiac.
Brochu	Champlain.
Brodeur	Timiskaming.
Brome	Brome.
Brompton	Richmond.
Brouague	Saguenay.
Broughton	Beauce.
Bruchési	Timiskaming.
Bryson	Pontiac.
Buckingham	Labelle.
Buckland	Bellechasse and Dorchester.
Buies	Maskinongé and St. Maurice.
Bulstrode	Arthabaska.
Bulstrode, Augm	"
Bungay	Kamouraska
Bureau	Champlain.
Bury	Compton.
Cabano	Témiscouata.
Cabot	Matane.
Cadieux	Champlain.
Cadillac	Timiskaming.
Caire	"
Callières	Charlevoix.
Calumet	Pontiac.
Cameron	Ottawa.
Campbell	Labelle.
Campeau	Timiskaming.
Cannon	Saguenay.
Cap-Chat	Gaspe.
Cap-Rosier	"
Carignan	Champlain.
Carleton	Bonaventure.
Caron	Lake St. John.
Carpentier	Timiskaming.
Cartier	Joliette.
Casault	Matane.
Casgrain	L'Islet.
Castagnier	Timiskaming.
Causapscal	Matane.
Cathcart	Joliette.
Cauchon	Montmorency.
Cawood	Pontiac.
Caxton	St. Maurice.
Caxton, Augm	"
Céry	Saguenay.
Chabert	Timiskaming.
Chabot	Kamouraska.
Champigny	Chicoutimi.
Chapais	Kamouraska.
Chapleau	Maskinongé.
Chapman	Champlain.
Chardon	Chicoutimi.
Charest	Champlain.
Charette	Pontiac.
Charlevoix	Lake St. John
Charnay	Saguenay.
Chassaigne	Maskinongé, Pontiac and St. Maurice.
Chasseur	Quebec.
Chateauvert	Champlain.
Chatham	Argenteuil.
Chaumont	Quebec.
Chauveau	Charlevoix.
Chauvin	Chicoutimi.
Chavigny	Portneuf.
Chazel	Timiskaming.
Chenier	Rimouski.
Cherbourg	Matane.
Cherrier	Pontiac.
Chertsey	Montcalm.
Chesham	Frontenac.
Chester	Arthabaska.
Chevalier	Saguenay.
Chichester	Pontiac.
Chicoutimi	Chicoutimi.
Chilton	Montcalm.
Chouinard	Champlain.
Choquette	Maskinongé & St. Maurice.
Christie	Gaspe.
Cimon	Chicoutimi.
Clapham	Pontiac.
Clarendon	"
Clericy	Timiskaming.
Clerion	"
Clermont	"
Cleveland	Richmond.
Clifton	Compton.
Clinton	Frontenac.
Cloridorme	Gaspe.
Closse	Pontiac.
Cloutier	Champlain.
Clyde	Labelle.
Coffin Island	Magdalen Islands.
Coigny	Timiskaming.
Colbert	Portneuf.
Coleraine	Megantic.
Compton	Compton.
Cook	Saguenay.
Coquart	Chicoutimi.
Couillard	"
Courcelles	Berthier.
Coursol	Pontiac.
Couture	Chicoutimi.
Courville	Timiskaming.
Cox	Bonaventure.
Cranbourne	Dorchester.
Crémazie	Champlain.
Crespieul	Lake St. John.
Crusson	Pontiac.
Cuvillier	"
Daaquam	Bellechasse.
Dablon	Lake St. John.
Dalibaire	Matane.
Dalmas	Lake St. John.
Dalquier	Timiskaming.
Dandurand	Champlain and St. Maurice.
Dansereau	Champlain.
Darlens	Timiskaming.
Dasserat	"
Daudhébourg	Saguenay.

TOWNSHIPS IN QUEBEC—*Continued.*

Township.	County or District.
David	Maskinongé & St. Maurice.
De Beaujeu	Gaspe.
De Calonnes	Maskinongé.
De Cazes	Lake St. John.
Decelles	Champlain.
Dechene	Lake St. John.
Delâge	Champlain.
Delbreuil	Timiskaming.
Delisle	Lake St. John.
De Maisonneuve	Berthier.
Demers	Témiscouata.
Demeules	Lake St. John.
De Monts	Saguenay.
Denholm	Ottawa.
Denonville	Témiscouata.
Denoue	Gaspe.
Dequen	Lake St. John.
Dequen, Augm	"
Derry	Labelle.
De Salaberry	Terrebonne.
De Sales	Charlevoix.
Desandroins	Timiskaming.
Desaulniers	St. Maurice.
Desboues	Timiskaming.
Deschamps	Pontiac.
Desmeloizes	Timiskaming.
Despinassy	"
Desroberts	"
Dessane	Champlain.
Destor	Timiskaming.
Devlin	"
Déziel	Champlain.
Dionne	L'Islet.
Disson	Timiskaming.
Ditchfield	Frontenac.
Ditton	Compton.
Dolbeau	Lake St. John.
Dollard	Pontiac.
Doncaster	Terrebonne.
Dorion	Pontiac.
Dorset	Frontenac.
Douglas	Gaspe.
Doussin	Pontiac.
Douville	Maskinongé & St. Maurice.
Drouin	Champlain.
Duberger	Lake St. John & Mistassini.
Dubois	Champlain and Lake St. John.
Dubuc	Chicoutimi.
Dubuisson	Timiskaming.
Duchesnay	Gaspe.
Duchesneau	Saguenay.
Ducreux	Chicoutimi.
Ducros	Timiskaming.
Dudley	Labelle.
Dudswell	Wolfe.
Dufay	Timiskaming.
Dufferin	Lake St. John.
Dufresnoy	Timiskaming.
Duhamel	"
Dumas	Chicoutimi.
Dumoulin	Champlain.
Dundee	Huntingdon.
Dunham	Missisquoi.
Duparquet	Timiskaming.
Duprat	"
Dupuis	Champlain.
Duquesne	Rimouski.
Durham	Drummond.
Durocher	Chicoutimi.
Duval	Saguenay.
Duverny	Timiskaming.
Eardley	Ottawa.
Eaton	Compton.
Eddy	Timiskaming.
Edwards	"
Egan	Ottawa.
Elgin	Huntingdon.
Ely	Shefford.
Emberton	Compton.
Escoumains	Saguenay.
Esher	Pontiac.
Estcourt	Témiscouata.
Evanturel	Champlain.
Fabre	Timiskaming.
Faguy	Champlain and Lake St. John.
Faillon	Pontiac.
Falardeau	Chicoutimi.
Farnham	Brome and Missisquoi.
Faucher	Chaplain and St. Maurice.
Ferland	Chicoutimi.
Fiedmont	Timiskaming.
Figuery	"
Fitzpatrick	Saguenay.
Flahault	Bonaventure.
Fleuriau	Matane and Rimouski.
Flynn	Rimouski.
Forsyth	Frontenac.
Fortier	Maskinongé & St. Maurice
Fortin	Gaspe.
Fournier	L'Islet.
Fournière	Timiskaming.
Fox	Gaspe.
Frampton	Dorchester.
Franklin	Huntingdon.
Franquelin	Saguenay.
Frechette	Champlain.
Frémont	"
Gaboury	Timiskaming.
Gagné	Chicoutimi.
Gagnon	Labelle.
Galt	Gaspe.
Garneau	L'Islet.
Garnier	Lake St. John.
Garthby	Wolfe.
Gaspe Bay, North	Gaspe.
Gaspe Bay, South	"
Gauthier	Berthier.
Gauvin	Lake St. John & Mistassini.
Gayhurst	Frontenac.
Gendreau	Timiskaming.
Gendron	Quebec.
Geoffrion	Champlain.
Gillies	Pontiac.
Girard	Lake St. John.

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TOWNSHIPS IN QUEBEC—*Continued.*

Township.	County or District.
Girouard	Pontiac.
Godmanchester	Huntingdon.
Gore	Argenteuil.
Gosford	Portneuf.
Gosselin	Berthier and Maskinongé.
Gouin	Joliette.
Goynish	Saguenay.
Granby	Shefford.
Grandison	Terrebonne.
Granet	Timiskaming.
Grantham	Drummond.
Gravel	Labelle.
Grenier	Saguenay.
Grenville	Argenteuil.
Grenville, Augm	Argenteuil.
Guay	Timiskaming.
Guérin	"
Guigues	"
Guyenne	"
Hackett	Champlain.
Halifax	Megantic.
Ham, North	Wolfe.
Ham, South	"
Hamel	Champlain.
Hamilton	Bonaventure.
Hampden	Compton.
Hanotaux	Champlain and Pontiac.
Harper	Champlain.
Harrington	Argenteuil.
Harrington, Gore	"
Hartwell	Labelle.
Harvey	Chicoutimi.
Hatley	Stanstead.
Havelock	Huntingdon.
Hébécourt	Timiskaming.
Hébert	Chicoutimi.
Hemmingford	Huntingdon.
Hereford	Compton.
Hereford, Gore	"
Hinchinbrook	Huntingdon.
Hincks	Ottawa.
Hocquart	Témiscouata.
Holmes	Pontiac.
Hope	Bonaventure.
Horton	Arthabaska and Nicolet.
Howard	Argenteuil.
Huard	Lake St. John.
Huddersfield	Pontiac.
Huguenin	Champlain.
Hull	Ottawa.
Humqui	Matane.
Hunterstown	Maskinongé.
Hunterstown, Gore	"
Huot	Champlain
Iberville	Saguenay.
Ingall	Champlain.
Inverness	Mégantic.
Ireland	"
Ixworth	Kamouraska.
Jersey	Beauce.
Jetté	Matane.
Joanne	Timiskaming.
Joliette	Berthier and Joliette.
Joly	Labelle.
Jonquière	Chicoutimi
Josselin	Pontiac.
Jourdan	Timiskaming.
Juneau	Pontiac.
Jurier	"
Kaine	Maskinongé.
Kalm	Pontiac.
Kecarpoui (archipelago)	Saguenay.
Kegashka	"
Kenogami	Chicoutimi.
Kensington	Ottawa.
Kiamika	Labelle.
Kildare	Joliette.
Kildare, Augm	"
Kilkenny	Montcalm and Terrebonne.
Kilkenny, Gore	Montcalm.
Kingsey	Drummond.
Laas	Timiskaming.
Labarre	Lake St. John.
Labelle	Labelle.
Labrecque	Chicoutimi.
Labrie	Pontiac.
Labrosse	Chicoutimi.
LaBruère	Lake St. John.
Lacasse	Champlain and Pontiac.
LaCorne	Timiskaming.
Lacoste	Charlevoix.
Lafiteau	Champlain and Lake St. John.
Laflamme	"
Laflèche	Saguenay.
Laflèche, Augm	"
Lafontaine	L'Islet.
Laforce	Gaspe.
Lagacé	Pontiac and Champlain.
Lagorgendière	Saguenay.
Lalande	"
Laliberté	Champlain.
Lallemant	Chicoutimi.
Lambton	Frontenac.
LaMinerve	Labelle.
Lamorandière	Timiskaming.
LaMotte	"
Lamy	Champlain.
Landanet	Timiskaming.
Landrienne	"
Landry	Champlain and St. Maurice.
Langelier	Champlain.
Langevin	Dorchester.
Languedoc	Timiskaming.
LaPause	"
Lapeyrère	Champlain.
Lapointe	Chicoutimi.
Laporte	"
LaReine	Timiskaming
Larocque	Gaspe.
Lartigue	Chicoutimi.
Lareau	Champlain.
Larue	Quebec.
Lasalle	Portneuf
La Sarre	Timiskaming.
Laperrière	"
Laterrière	Chicoutimi.

TOWNSHIPS IN QUEBEC—*Continued.*

Township.	County or District.
Lathbury	Labelle.
Latour	Saguenay.
Latulipe	Timiskaming.
Laubanie	"
Launay	"
Laure	Quebec.
Laurier	Champlain.
Laval	Saguenay.
Lavallée	Champlain.
Laverlochère	Timiskaming.
Lavigne	Champlain.
Laviolette	Maskinongé.
Lavoie	Quebec.
Leau	Champlain and St. Maurice.
Leblanc	Champlain.
Lecomte	Pontiac.
Leeds	Mégantic.
LeGardeur	Saguenay.
Leigne	Pontiac.
Lejeune	Champlain.
Lemay	"
Lemoine	Abitibi.
Leneuf	Saguenay.
Lepage	Matane.
Lesage	Labelle.
Lescarbot	Quebec.
Leslie	Pontiac.
Lessard	L'Islet.
Lestres	Pontiac.
Letellier	Saguenay.
Letondal	Champlain.
Levasseur	"
Leverrier	L'Islet.
Liénard	Saguenay.
Ligneris	Timiskaming.
Lindsay	Champlain and Lake St. John.
Lingwick	Compton.
Linière	Beauce.
Litchfield	Pontiac.
Livernois	Champlain.
Lochaber	Labelle.
Lochaber, Gore	"
Logan	Pontiac.
Loranger	Labelle.
Lortie	Champlain.
Louise	Frontenac.
Louvicourt	Timiskaming.
Low	Ottawa.
Lussier	Montcalm.
Lynch	Labelle and Montcalm.
Lytton	Ottawa.
McCorkill	Abitibi, Lake St. John and Mistassini.
McGill	Labelle.
McKenzie	Abitibi.
McLachlin	Timiskaming.
McNider	Matane.
McNider, Augm	"
Macpès	Rimouski.
McSweeny	Champlain.
Maddington	Arthabaska and Nicolet.
Magnan	Champlain.
Magog	Stanstead.
Mailloux	Bellechasse.
Major	Labelle.
Malakoff	Pontiac.
Malartic	Timiskaming.
Malbaie	Gaspe.
Malherbe	Lake St. John.
Malhiot	Champlain.
Manikuagan	Saguenay.
Maniwaki	Ottawa.
Mann	Bonaventure.
Manneville	Timiskaming.
Mansfield	Pontiac.
Marchand	Labelle.
Maria	Bonaventure.
Maricourt	Pontiac.
Marlow	Frontenac.
Marmette	Champlain.
Marmier	Portneuf.
Marquette	Lake St. John.
Marrias	Timiskaming.
Marsal	Saguenay.
Marston	Frontenac.
Martin	Pontiac.
Masham	Ottawa.
Massé	Matane and Rimouski.
Masson	Maskinongé.
Matalik	Matane.
Matane	"
Matapedia	Bonaventure.
Mathieu	Champlain.
Mazenod	Timiskaming.
Mazerac	"
Mazères	Pontiac.
Meilleur	Lake St. John.
Mekattina (archipel du Petit)	Saguenay.
Mekattina (archipel du Gros)	"
Mekinak	Champlain.
Melbourne	Richmond.
Mercier	Timiskaming.
Mesplets	Pontiac.
Mésy	Lake St. John.
Metabetchouan	"
Metgermette, North	Beauce.
Metgermette, South	"
Michaux	Quebec.
Milnikek	Bonaventure.
Milton	Shefford.
Milton, Gore	"
Miniac	Timiskaming.
Moisie	Saguenay.
Montague	Timiskaming.
Montanier	"
Montauban	Portneuf.
Montbeillard	Timiskaming.
Montbray	"
Montcalm	Argenteuil.
Montesson	Saguenay.
Montgay	Timiskaming
Montigny	Labelle.
Mont Louis	Gaspe.
Montminy	Montmagny.
Montpetit	Champlain and St. Maurice.
Montreuil	Timiskaming.
Moquin	Pontiac.
Moreau	Labelle.

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TOWNSHIPS IN QUEBEC—*Continued.*

Township.	County or District.
Morin	Argenteuil and Terrebonne.
Mortague	Timiskaming.
Mousseau	Labelle and Montcalm.
Mulgrave	Labelle.
Muskwaro	Saguenay.
Myrand	Champlain.
Natashkwan	Saguenay.
Nantel	Montcalm.
Nedelec	Timiskaming.
Neigette	Rimouski.
Neilson	Quebec.
Nelson	Megantic.
Nemtaye	Matane.
Nevers	Champlain
Newport	Gaspe.
Newport	Compton.
New Richmond	Bonaventure.
Newton	Vaudreuil.
Newton, Augm	"
Noiseaux	Pontiac
Normand	Champlain.
Normandin	Lake St. John.
Northfield	Ottawa.
Nouvelle	Bonaventure.
Obalski	Abitibi.
Olscamps	Champlain.
Onslow	Pontiac.
Orford	Sherbrooke.
O'Sullivan	Mistassini.
Otis	Chicoutimi.
Ouapitagone (archipelago)	Saguenay.
Ouiatchouan	Lake St. John.
Ouimet	Rimouski.
Packington	Témiscouata.
Painchand	Kamouraska.
Palmarolle	Timiskaming.
Panet	Montmagny.
Papin	Quebec.
Papineau	Labelle.
Parent	Lake St. John.
Parke	Kamouraska.
Pascalis	Timiskaming.
Patapedia	Bonaventure.
Patton	Montmagny.
Payment	Champlain.
Pelissier	Timiskaming.
Pelletier	Lake St. John.
Percé	Gaspe.
Périgny	Chicoutimi.
Perrault	Quebec.
Perrier	Champlain and Pontiac.
Peterborough	Berthier and Maskinongé.
Petit	Lake St. John.
Peuvret	Saguenay.
Phelyppeaux	"
Picard	Champlain.
Pinault	Matane.
Plessis	Chicoutimi.
Pohenegamook	Kamouraska.
Poisson	Champlain, Pontiac and St. Maurice.
Polette	Champlain.
Ponsonby	Labelle.
Pontbriand	Lake St. John.
Pontefract	Pontiac.
Pontchartrain	Saguenay.
Pontgravé	"
Pontleroy	Timiskaming.
Pope	Labelle.
Port Daniel	Bonaventure.
Portland	Labelle.
Portneuf	Saguenay.
Pothier	Champlain.
Potton	Brome.
Poularies	Timiskaming.
Preissac	"
Preston	Labelle.
Price	Frontenac.
Privat	Timiskaming.
Provancher	Champlain & St. Maurice
Provost	Berthier.
Racine	Lake St. John.
Radnor	Champlain.
Raffeix	Saguenay.
Ragueneau	"
Rameau	Gaspe.
Raudot	Témiscouata.
Rawdon	Montcalm.
Remigny	Timiskaming
Rhéaume	Champlain.
Rhodes	Montmorency and Quebec.
Richardson	Abitibi and Mistassini.
Ripon	Labelle.
Risborough	Frontenac.
Ristigouche	Bonaventure.
Rivard	Labelle.
Robertson	"
Roberval	Lake St. John.
Robidoux	Bonaventure.
Robin	Pontiac.
Robinson	Témiscouata.
Robitaille	"
Rocheblave	Labelle.
Rochebeaucourt	Timiskaming.
Rochemonteix	Saguenay.
Rochon	Labelle.
Rocmont	Portneuf.
Rolette	Montmagny.
Rolland	Montcalm.
Romieu	Matane.
Roquemaure	Timiskaming.
Ross	Lake St. John.
Roubaud	Timiskaming.
Rouillard	Témiscouata.
Routhier	Champlain and Lake St. John.
Roux	Bellechasse.
Rouyn	Timiskaming.
Roxton	Shefford.
Roy	Abitibi and Mistassini.
Royal-Roussillon	Timiskaming.
Royer	Saguenay.
Sabourin	Timiskaming.

TOWNSHIPS IN QUEBEC—*Concluded.*

Township.	County or District.
Sagard	Saguenay.
Saguenay	"
St. Augustin (archipelago)	"
St. Camille	Wolfe.
St. Denis	Matane.
St. Germain	Chicoutimi.
St. Hilaire	Lake St. John.
St. Jean	Chicoutimi.
Ste. Marie (archipelago)	Saguenay.
St. Maurice	St. Maurice.
Saint-Père	Pontiac.
St. Vincent	Saguenay.
Scott	Abitibi.
Senneterre	Pontiac and Timiskaming.
Sennville	Timiskaming.
Sérigny	Pontiac.
Settrington	Charlevoix.
Shawenegan	St. Maurice.
Sheen	Pontiac.
Shefford	Shefford.
Shehyn	Timiskaming.
Shenley	Beauce.
Sherrington	Napierville.
Sherrington, Gore	"
Shipton	Richmond.
Sicotte	Ottawa.
Signai	Lake St. John.
Silvy	Chicoutimi.
Simard	"
Simpson	Arthabaska & Drummond
Sincennes	Champlain
Somerset	Megantic.
Somerset, Augm	"
Spalding	Frontenac.
Squart	Pontiac.
Stanbridge	Missisquoi.
Standon	Dorchester.
Standon, Augm	"
Stanfold	Arthabaska.
Stanstead	Stanstead.
Stoke	Richmond.
Stoneham	Quebec.
Stratford	Wolfe.
Stukely	Shefford.
Suffolk	Labelle.
Sulte	Champlain.
Surimau	Timiskaming.
Sutton	Brome.
Sydenham	Gaspe.
Suzor	Champlain.
Tabaret	Timiskaming.
Taché	Chicoutimi.
Tadoussac	Saguenay.
Taillon	Lake St. John.
Talon	Montmagny.
Tanguay	Lake St. John.
Tarte	Champlain.
Taschereau	Gaspe.
Tassé	Champlain.
Tavernier	Pontiac.
Tellier	Joliette.
Templeton	Ottawa.
Templeton, Gore	"
Tessier	Matane.
Tewkesbury	Quebec.
Thetford	Megantic.
Thorne	Pontiac.
Tillemont	Pontiac.
Tingwick	Arthabaska.
Tonnancour	Pontiac.
Tonti	Portneuf.
Tourelle	Gaspe.
Tourouvre	Champlain.
Toussaint	"
Tracy	Berthier.
Trécesson	Timiskaming.
Tremblay	Chicoutimi.
Trévet	Pontiac.
Tring	Beauce.
Trudel	Quebec.
Turcotte	Champlain.
Turgeon	Labelle.
Upton	Bagot, Drummond and Yamaska.
Upton, Gore	Bagot.
Valets	Pontiac.
Vallières	Champlain.
Valmy	Pontiac.
Varsan	Timiskaming.
Vassal	"
Vasson	Pontiac.
Vaudray	Timiskaming.
Vauquelin	Pontiac.
Verreau	Champlain and Lake St. John.
Vieux Fort (archipelago)	Saguenay.
Viger	Témiscouata.
Vilars	Timiskaming.
Villemontel	"
Villeneuve	Labelle.
Wabassee	"
Wakefield	Ottawa.
Waltham	Pontiac.
Ware	Bellechasse and Dorchester.
Warwick	Arthabaska.
Washicoutai (archipelago)	Saguenay.
Watford	Dorchester.
Weedon	Wolfe.
Weir	Bonaventure.
Wells	Labelle.
Wendover	Drummond and Nicolet.
Wendover, Gore	Yamaska.
Wentworth	Argenteuil.
Westbury	Compton.
Wexford	Montcalm and Terrebonne.
Weymontachingue	Champlain.
Whitton	Frontenac.
Whitton, Gore	"
Whitworth	Témiscouata.
Wickham	Drummond.
Windsor	Richmond.
Winslow	Frontenac.
Woburn	"
Wolfe	Terrebonne.
Wolfestown	Wolfe.
Woodbridge	Kamouraska.
Wotton	Wolfe.
Wright	Ottawa.
Wurtele	Labelle.
York	Gaspe.

TOWNSHIPS IN NOVA SCOTIA.

Township.	County
Amherst	Cumberland.
Annapolis	Annapolis.
Argyle	Yarmouth.
Arisaig	Antigonish.
Aylesford	Kings.
Barrington	Shelburne.
Boularderie (island)	Cape Breton.
Chester	Lunenburg.
Clare	Digby.
Clements	Annapolis.
Cornwallis	Kings.
Dartmouth	Halifax.
Digby	Digby.
Digby Neck	"
Dorchester	Antigonish.
Douglas	Hants.
Economy	Colchester.
Egerton	Pictou.
Falmouth	Hants.
Granville	Annapolis.
Guysborough	Guysborough.
Guysborough	Queens.
Horton	Kings.
Halifax	Halifax.
Hillsborough	Digby.
Kempt	Hants.
Kemptown	Colchester.
Liverpool	Queens.
Londonderry	Colchester.
Long Island	Digby.
Lunenburg	Lunenburg.
Louisburg	Cape Breton.
Maitland	Hants.
Manchester	Guysborough.
Maxwellton	Pictou.
Milford	Guysborough.
Mira	Cape Breton.
Morristown	Antigonish.
New Dublin	Lunenburg.
Newport	Hants.
Oldham	Halifax.
Onslow	Colchester.
Pictou	Pictou.
Preston	Halifax.
Rawdon	Hants.
Sackville	Halifax.
St. Andrews	Antigonish.
St. Andrews	Cape Breton
St. Josephs	Antigonish.
St. Marys	Guysborough.
Shelburne	Shelburne.
Shubenacadie	Hants.
Stewiacke	Colchester.
Stirling	"
Stormont	Guysborough.
Sydney	Cape Breton.
Tangier	Halifax.
Tatamagouche	Colchester.
Tracadie	Antigonish.
Truro	Colchester.
Uniacke	Hants.
Walton	"
Wilmot	Annapolis.
Wilmot	Guysborough.
Windsor	Hants.
Weymouth	Digby.
Yarmouth	Yarmouth.

PARISHES IN NEW BRUNSWICK.

Aberdeen	Carleton.
Acadieville	Kent.
Addington	Restigouche.
Alma	Albert.
Alnwick	Northumberland.
Andover	Victoria.
Balmoral	Restigouche.
Bathurst	Gloucester.
Beresford	"
Blackville	Northumberland.
Blissfield	Northumberland.
Blissville	Sunbury.
Botsford	Westmorland.
Bright	York.
Brighton	Carleton.
Brunswick	Queens.
Burton	Sunbury.
Cambridge	Queens.
Campobello	Charlotte.
Canning	"
Canterbury	York.
Caraquet	Gloucester.
Cardwell	Kings.
Carleton	Kent.
Chatham	Northumberland.
Chipman	Queens.
Clarendon	Charlotte.
Clair	Victoria.
Cloverdale	Albert.
Colborne	Restigouche.
Dalhousie	"
Derby	Northumberland.
Dorchester	Westmorland.
Douglas	York.
Drummond	Victoria.
Dufferin	Charlotte.
Dumbarton	"
Dumfries	York.
Dundas	Kent.
Durham	Restigouche.
Eldon	"
Elgin	Albert.
Gagetown	Queens.
Gladstone	Sunbury.
Glenelg	Northumberland.
Gordon	Victoria.
Grand Falls	"
Grand Manan	Charlotte.
Greenwich	Kings.
Hammond	"
Hampstead	Queens.
Hampton	Kings.
Harcourt	Kent.
Hardwicke	Northumberland.
Harvey	Albert.

PARISHES IN NEW BRUNSWICK—*Concluded.*

Parish.	County.
Havelock	Kings.
Hillsborough	Albert.
Hopewell	"
Huskisson	Kent.
Inkerman	Gloucester.
Johnston	Queens.
Kars	Kings.
Kent	Carleton.
Kingsclear	York.
Kingston	Kings.
Lancaster	St. John.
Lepreau	Charlotte.
Lincoln	Sunbury.
Lorne	Victoria.
Ludlow	Northumberland.
McAdam	York.
Madawaska	Madawaska.
Manners Sutton	York.
Maugersville	Sunbury.
Moncton	Westmorland.
Musquash	St. John.
Nelson	Northumberland.
New Bandon	Gloucester.
Newcastle	Northumberland.
New Maryland	York.
Northampton	Carleton.
Northesk	Northumberland.
Northfield	Sunbury.
North Lake	York.
Norton	Kings.
Paquetville	Gloucester.
Peel	Carleton.
Penfield	Charlotte.
Perth	Victoria.
Petersville	Queens.
Prince William	York.
Queensbury	"
Richibucto	Kent.
Richmond	Carleton.
Rogersville	Northumberland.
Rothesay	Kings.
Sackville	Westmorland.
St. Andrews	Charlotte.
St. Anns	Madawaska.
St. Basil	"
St. Croix	Charlotte.
St. David	"
St. Francis	Madawaska.
St. George	Charlotte.
St. Hilaire	Madawaska.
St. Isidore	Gloucester.
St. Jacques	Madawaska.
St. James	Charlotte.
St. Leonard	Madawaska.
St. Louis	Kent.
St. Martins	St. John.
St. Mary	Kent.
St. Marys	York.
St. Patrick	Charlotte.
St. Paul	Kent.
St. Stephen	Charlotte.
Salisbury	Westmorland.
Saumarez	Gloucester.
Sheffield	Sunbury.
Shediac	Westmorland.
Shippigan	Gloucester.
Simonds	St. John
Simonds	Carleton.
Southampton	York.
Southesk	Northumberland.
Springfield	Kings.
Stanley	York.
Studholm	Kings.
Sussex	"
Upham	"
Wakefield	Carleton.
Waterboro	Queens.
Waterford	Kings.
Weldford	Kent.
Wellington	"
Westfield	Kings.
West Isles	Charlotte.
Westmorland	Westmorland.
Wickham	Queens.
Wicklow	Carleton.
Wilmot	"
Woodstock	"

THIRTEENTH REPORT OF THE GEOGRAPHIC BOARD OF CANADA

APPENDIX

AN OUTLINE

OF THE

PHYSICAL GEOGRAPHY OF CANADA

BY

D. B. DOWLING

OUTLINE OF THE

PHYSICAL GEOGRAPHY OF CANADA

Of the early American continent—its formation and subsequent outline, as it passed through the ages leading up to the habitation of the seas by living forms—we can form but a shadowy mental picture. Fragments of very early sediments are found, which indicate the presence of land areas; and in even the oldest of these there is a suggestion of the character of the material surface from which they were derived. Many interesting problems relating to the origin of these early beds have been solved; but in the search for the original crust all efforts have been vain. We must conclude, therefore, that the original crust or first consolidated land, as well as the first sediments derived from it, has been worn away from a large part of the continent; and where it has not been removed, has been entirely altered by contact with molten masses or by subsidence to zones of high temperatures. A comparatively stable continent can, however, be traced back to about the period at which the seas became habitable, or to the dawn of life on the planet. The continent, at the time of our first fairly clear conception of it had already passed through a long history; its mountains had been worn down, and the only topographic features of importance, except its outline, consisted of scars or depressions marking weakly-supported areas. Various changes in its outline, caused by subsidence and elevation, have been traced; but its early, though somewhat larger form, bore a distinct resemblance to the present continent. It extended to Greenland and probably to the Asiatic shores, but was not definitely connected to the South American land area.

The great erosion, which resulted in the general flattening of this old continent, exposed granites and other crystalline rocks which, while in a molten condition, had played their part in the destruction of the original crust. The general surface thus exposed may be likened to a mosaic in which the base, mostly of light-coloured plutonic rocks, is ornamented by the insertion of green and grey patches of sedimentaries, volcanics and various highly altered rocks. This old surface which forms the basis of the present continent is generally referred to as the Canadian Shield. Its subsequent history includes a further smoothing of the surface by erosion, a deformation of its borders by tangential strains and the invasion of its surface by the sea when, during periods of crustal strain, various portions were depressed. The occurrence of these periods of depression followed by elevation is proved by the marine sediments now found on the continent. The entombed remains of once living organisms show a gradual change in the forms of life, sufficient, with the crustal movements, to form the basis for a chronological division of the time elapsed, sometimes estimated at thirty million years, since the beginning of life on the planet. During this time the continent regained its original area three times after equally long periods of instability; but during the last three million years there has been very little change in its outline, though in that time the Rocky mountains have been built and many of the channels through the Arctic archipelago have been formed.

The topographic features of the present surface of the continent admit of its division, in Canada, into several physiographic provinces. The exposed surface of the old pre-Cambrian continent forms one of the largest divisions and has been called the Canadian Shield, the Archean peneplain and in its southern portion, the Laurentian Highland. The mountainous country of the west constitutes the Cordillera, while the mountains of eastern United States, in their continuation across the border, form the Appalachian Highlands of eastern Canada. The Great Plains, with various subdivi-

sions, occupy the area between the mountainous area of the west and the great, roughened surface of the Canadian Shield. The St. Lawrence Lowland lies between the Laurentian and Appalachian Highlands. Within the borders of the Canadian Shield an area on the southern margin of Hudson bay has been referred to as the Clay Belt. It occupies a part of the basin that was submerged during the Glacial period and covered with a coating of clay which smoothed over its inequalities and concealed most of the underlying rocks. Since its emergence the surface has been but slightly altered by drainage channels cut across it.

THE CANADIAN SHIELD.

The portion of the pre-Cambrian continent whose exposed surface still forms a large part of Canada, has an area of about two and a half million square miles. Its northern border crosses the Arctic archipelago, the eastern lies beyond Baffin land and Labrador and reaches the depressed area occupied by the St. Lawrence river, a short spur or point crossing this valley at the outlet of lake Ontario to join the Adirondack mountains in New York. The southern boundary runs from the spur west to Georgian bay, skirts the north shore of lake Huron and sweeps almost entirely around the ancient depressed area occupied by lake Superior. The western edge, from the lake of the Woods and lake Winnipeg, bears northwest to the western end of lake Athabaska, and passes through the basins occupied by Great Slave and Great Bear lakes, reaching the Arctic ocean east of the Mackenzie River delta. In detail, the surface features of the Canadian Shield are irregular; but, viewed broadly, it has the conformation of a great plain, depressed toward the centre and in the north and slightly elevated along the eastern and southern borders, where it presents a somewhat steep outward slope. The general elevation in the eastern portion is under 2,000 feet, and over the larger part of the plain is about 1,000 feet. The highest portion is along the northeastern margin where it presents a steep face to the sea. Its outline and section suggests faulting or a great fracture along the coast and a subsidence of the crust to the east of the fault. The northern border which passes through the Arctic islands shows great differential erosion, the result possibly of fractures and faulting. The great elevations found on the eastern shore of Baffin island, north of Cumberland sound, lie to the eastward of the supposed line of faulting parallel to the Labrador coast, and appear to be an elevated block lying in the fractured zone which now constitutes the submerged strip between Greenland and the Canadian shores.

On account of its hummocky nature, the surface of the Canadian Shield is dotted with innumerable lakes, the majority of which are rock basins. The surface being profoundly glaciated and most of the former debris carried southward, the present drainage is not impressed on the rock surface, but rather follows pre-existing depressions and occasionally former drainage channels. Remnants of these old channels, some of which are very ancient, are found near the border of the plateau, such as the Ottawa River channel, the smaller, Gatineau River valley, the depression through which the St. Maurice river flows, the deep channel of the Saguenay and the deep cut occupied by Hamilton inlet on the Labrador coast. In the case of the northern drainage most of the channels seem to have followed structural breaks; but the outlet from Hudson bay and such features as Chesterfield and Wager inlets have resulted apparently from erosion.

The effects of pressure folding, to which the outer edges of the old continent were subjected, are but faintly seen over most of this area. The various earth movements are shown here mainly in the records of subsidences and elevations which affected portions of the area and allowed recurring invasions by the sea. The greatest subsidence was probably during the Trenton period, about the middle of the Palæozoic era,

when the form of the continent was for a time greatly changed. The area under consideration consisted then of four islands, namely:—

(1) The eastern part of Baffin island which was joined to Greenland.

(2) The larger part of the Labrador peninsula.

(3) An area northwest of lake Superior which extended to the Nelson River depression.

(4) An area west of Hudson bay and east of the Mackenzie valley.

These portions of the Canadian Shield appear to have remained above the sea from a very early period.

At the beginning of Devonian time these islands were probably rejoined; but a depression remained to the west and south. At the close of the Devonian period, an elevation of the northern edge of the continent, which progressed southward throughout Carboniferous time, caused the sea to retreat slowly southward from the depression.

The basin now occupied by Baffin bay was probably not formed until after Cretaceous times, since the trap overflows now found along the Greenland shores, which are probably evidence of the crustal movements of the time, are of Tertiary age. The latest continental movement, which effected this area in a slight degree only, was a depression during the Glacial period, followed by a partial recovery after the removal of the ice mass. This is shown by modern beaches and marine-clay plains now above the sea, in the lowlands and in the Clay Belt south of Hudson bay.

THE CORDILLERAN REGION.

The western part of the American continent is more or less mountainous. The Andean chain which extends throughout the length of South America, broadens out in North America and, in Canada, has an average width of over 500 miles. This region is the most elevated in Canada, many of the summits reaching heights of 10,000 feet, with occasional peaks over 13,000 feet above sea-level. The mountainous tract forming the Cordillera can be divided broadly into three parallel bands: an old series of plateaus and mountains forming the central part, referred to as the Interior System of Plateaus and Mountains, a young series of parallel ridges, east of the central plateaus, formed of fault blocks and folds and known as the Rocky mountains, and a third division, between the plateau country and the Pacific, called the Coastal System. This system consists of two topographic divisions: a granitic ridge or mountain range, which borders the coast, and an interrupted range forming the mountainous Vancouver island, the Queen Charlotte group and the islands of the archipelago at the northwestern corner of British Columbia.

The interior system of plateaus and mountains has had a very long history of elevation and subsidence, resulting in alternating periods of denudation and deposition. The Rocky mountain system is more modern and its ridges show very little erosion except the removal of the debris caused by the earth-fracturing. The Coast system is slightly older than the Rockies, having undergone considerable erosion before their elevation.

Historical Note.

The central part of the Cordilleras has long been a topographic feature of the continent, having a history extending almost as far back as that of the Laurentian plateau. No land areas of this remote date are preserved; but rocks formed from the debris of this land remain and give evidence of having been in turn subjected to intensive erosion which almost entirely removed them and formed from their debris the deposits in which are found the earliest forms of life. These deposits were raised

above the sea in early Palæozoic time and in turn formed a land area on which the sea encroached during Carboniferous times. The close of the Palæozoic was marked by a shallowing of the sea, which separated this ridge from the Laurentian plateau to the east, and a general elevation of the land. This elevation was possibly more pronounced throughout the region now occupied by the Coast range, as, in Jurassic time, the sediments forming the outer crust were raised by the injection of molten granite beneath. Volcanic activity followed this great movement and outflows of this period are to be found on both sides of the mountain range then formed. A subsidence of adjacent areas is marked by deposits of early Cretaceous age; but in the interior, the latter part of the period is marked by denudation and levelling of the surface; and in the Coast range, by the removal of most of the stratified deposits overlying the granite batholith. The last invasion of the continent by the sea occurred during this period, when the western portion was separated from the eastern by the Cretaceous sea.

The close of the Cretaceous introduces a great period of elevation, not of the coastal area but of the interior belt and the part now occupied by the great plains. The continent then began to assume the outline it has at present. The further denudation of the Coast range and its dissection, the deep trenching of the plateau country and the forcing up of the ridges constituting the Rocky mountains were the principal occurrences. The period generally assigned to the building of the Rocky mountains is that covering the close of the Eocene but has been termed the Laramide revolution. Although volcanic outflows covered great tracts of the interior during this period, the violence of the crustal stresses were mainly spent in the formation of the Rocky mountains. A variation of the many periods of erosion and change of form was introduced in the Glacial period, when, owing to climatic changes, a great mass of ice spread in thick streams down the water-worn channels and over the lower rugged summits, smoothing their outlines and deepening and widening the valleys.

The Rocky Mountain System.

The Rocky Mountain System embraces all the ranges lying to the east of the remarkable valley called the Rocky Mountain trench, which extends from the United States boundary into Alaska. All along this strip the mountains maintain a remarkable uniformity in structure and are youthful in outline. The belt narrows and is considerably lower where it is cut by the valleys of the Peace and Liard rivers, but broadens northward by the addition of other ranges. The system includes: the Rocky mountains proper, which extend from the international boundary to the Liard river; the Mackenzie mountains, lying between the Mackenzie valley and the Yukon plateau; the Franklin mountains, a narrow ridge east of the Mackenzie river; and the Richardson mountains, near the Arctic ocean.

THE ROCKY MOUNTAINS.

On the basis both of form and of structure the Rocky mountains are divisible into two parts: a western and an eastern part. The axial ranges constituting the western part have been carved from a slightly-folded but greatly-elevated block, the denudation of which was probably inaugurated before the eastern ranges were elevated. The eastern part is made up of monoclinal blocks composed of beds that are generally of later formation than those of the western part of the mountains.

The eastern ranges, in a topographic sense, are merely blocks elevated to successively higher elevations than those of the foothills and from which nearly all the later and softer beds have been removed, exposing the more consolidated Palæozoic sediments beneath. These ridges, in contrast to the country of the central part of the

Cordillera, are veritable rock ridges, mostly grey limestone, not masked by a covering of sands and clays on which dense forests could grow. The fault blocks of which they are composed are, as a rule, tilted westward and along their eastern, scarped faces remnants are found that show the bending that occurred in these hard beds before the final break and overthrust of one block on the downturned edge of the one in front. The plane of the overthrust is frequently inclined to the west and this tilting is taken to indicate that the direction of the strain was from the west. The fault at the eastern edge of the mountains is often of this character, and the amount of overthrust, although great in Montana, is smaller in the Canadian ranges. In southern Alberta, on the British Columbia boundary, the Palæozoic limestones of the watershed range overlap the Cretaceous sandstones and shales which are found on the western edge of the fault block tilted up to form the Livingstone range, and several blocks of limestone are there stranded in somewhat the same manner as a block of ice on a shore. Crowsnest mountain is one of these remnants, being a limestone mass reposing on rocks younger than itself.

The similarity in outline of these ridges is the result of a general uniformity of dip and composition in the beds. The western slopes are very uniform, following generally the bedding planes of the rocks; but on the eastern slopes or those near the fault planes the slopes are often abrupt. Local glaciers have, moreover, etched this face into cirques and thereby contributed to the irregularity of the crest line.

The western ranges, or those near the watershed, are in contrast to those to the east in that they stand in higher masses, have more massive bases and have more elevated, glacier-clad summits. The scenery is of an alpine character; the small cirques found along the face of the ranges give place to great amphitheatres, such as those in the vicinity of lake Louise at Laggan.

The history of the ranges dates back to the appearance of low ridges in Jurassic times, representing the western part of the Rocky mountains, but the major movement of the crust is thought to belong to the Oligocene.

THE MACKENZIE MOUNTAINS.

This part of the great Rocky Mountain System constitutes the greatest mountain group in Canada and consists of several ranges, which can be divided into two groups in the same manner as the ranges of the Rocky mountains proper to the south.

The western part is the result of an older uplift and bears evidence of long-continued differential erosion. The eastern ranges are newer and bear a direct relationship to the eastern ranges farther south: their structure is due to the faulting, folding and buckling of the outer crust and they present the appearance of faulted and tilted blocks. The principal lines of fracture are in a northwest-southeast direction and the prevailing dip of the beds is southwest.

The actual divide is not the most important element in the relief of the region, the mountains in the vicinity of the watershed not rising higher than many of the groups situated at distances from it. The line separating the two topographic divisions appears to be to the east of the divide; and in the eastern or younger ranges may also be included the ridges lying east of the Mackenzie river known as the Franklin mountains. These, although not of great elevation, are prominent, as they are somewhat isolated and are probably due to the same great earth movement. An interrupted continuation of the system northwestward, near the Arctic sea, is also described as being of the typical Rocky Mountain structure.

The western border of this great mountain system has been placed by custom at the structural and erosion valley called the Rocky Mountain trench. This valley has been traced intermittently, through a course supposed to be continuous, from Flathead lake in Montana to the Yukon-Alaska boundary, a distance of nearly 1,500 miles. In

its course the depression is occupied by parts of many streams. The Kootenay river, rising in the Rocky mountains, passes southward through the valley; the Columbia rises in small lakes in the valley and flows northward in the trench, eventually leaving it to journey southward; the Fraser also, near its source, flows northward in it and farther down doubles southward.

The Peace river flowing through a gap in the Rocky mountains drains a part of the trench by two long north and south branches. The trench is next tapped by the Liard river which carries a small drainage from it to the Mackenzie river. Farther north the valley is occupied in part by branches of the Yukon and has been recognized in the Klondike country as a smaller valley entering the Yukon near Dawson.

The Interior System of Plateaus and Mountains.

The Rocky Mountain trench is the most convenient line of demarcation between the Rocky mountains and the Interior mountains and plateaus. Other great lines of erosion serve as boundaries for the subdivision of the mountain masses of the southern part of central British Columbia. The Rocky Mountain trench is thus the eastern boundary of the Selkirk system of mountains and the Selkirk valley is its western boundary. This system is further subdivided by the Purcell trench into the Purcell mountains and the Selkirk mountains. The Columbia System lies to the west of the Selkirk valley and extends to Kettle river, merging along its northern border into the Interior plateaus. The character of these two great systems is, in the main, of alpine type with deep valleys; the general summit level is from 6,000 to 9,000 feet above tide. The Cariboo mountains form another unit, standing above the plateau country. These are the several Gold ranges of early writers and are, indeed, of more economic importance from their metallic minerals than either the Rockies or Coast ranges.

The plateau country, viewed from the valleys by which the country is generally traversed, appears mountainous but, on examination from the upland, is found to have a generally flat summit level through which deep stream-valleys have been cut. That it has not been so dissected as to produce a mountainous topography is probably due to the comparative recency of the uplift that revived the streams and to the smoothing action of the general glaciation.

The great valleys that traverse the plateau country head near the Rocky mountains and find their outlets to the sea through the Coast range, by the cañons of the Fraser, Skeena, and Stikine, and northward, around the mountains, by the Yukon. There is also an eastward drainage through the Rocky mountains, by the upper branches of the Peace and Liard rivers.

Remnants of former drainage channels are also found and are occasionally prospected, as are the present channels, for alluvial gold. The wearing down, shifting and sorting of the debris from this old land surface has concentrated the gold derived from some of the old rocks and placer gold is now being obtained from the river beds of the Fraser and its branches, in the Cariboo country and from streams in the Yukon.

Lake basins, evidently on old drainage channels, are also a feature of the plateau country. Lakes such as the Shuswap and Quesnel lakes which occupy narrow, irregular basins in the plateau country, and the Kootenay, Arrow and Okanagan lakes in the southern mountain region belong to a former erosion period.

The Coast Range.

This belt of mountains is generally from 60 to 80 miles in width, and is a deeply-dissected, granitic mass or batholith, in which the summits near the sea stand at elevations of 4,000 to 5,000 feet. Near the axis of the range the summits are found at elevations of 7,000 to 8,000 feet. The mountains are massive, with steep, often craggy slopes and rounded dome-shaped summits. The heights are fairly uniform, with a few isolated peaks rising above the general level.

The valleys are deep and steep-sided and penetrate the ranges in all directions. Glaciers are numerous, especially in the higher latitudes, and occupy the upper portions of the valleys. Dense forests clothe the lower slopes to an elevation of 4,000 feet. A fiord system indents the range, which resembles that of Norway though it is on a grander scale. The deep dissection of the range during a period of greater continental elevation may have been influenced and aided by structural fractures, but the larger penetrating valleys in some instances point to the existence of drainage channels which date back to nearly Cretaceous times, or at least to a period which is almost as remote as the building of the mountain chain. The typical rounded summits of the hills and the steep-sided valleys are the result of a profound glaciation, by which the original rough peaks and valley trenches have been modified.

The dissection and subsequent subsidence and glaciation has produced an exceedingly intricate coast line, in front of which groups of islands are separated from the main land and from one another in many cases by deep, narrow channels. These channels are of value as highways of commerce along the coast, providing long stretches of sheltered waterways for the coastwise trade.

The rugged mountains rising steeply in close proximity to the navigable channels, their sides clothed with dark fir and cedar and their summits topped with glacier or rock mass, form a most impressive picture.

The large drainage channels which cut the range at intervals serve as outlets for the drainage of the interior country. The principal channels are the valleys of the Fraser and Skeena rivers, both of which are traversed by transcontinental railway lines. The Fraser valley, which near its outlet is close to the United States boundary, originated in a drainage that had its inception in Cretaceous or early Tertiary times; and the delta deposit at its mouth which extends south into Washington is evidence of the active erosion of the plateau land of the interior. The valley follows a course influenced greatly by structural features. It was broadened, straightened, and smoothed by the scouring of a heavy glacial stream. A late period of activity in its erosion, due no doubt to post-Glacial uplift, is shown in the incision of a narrow rock channel in the old valley floor, leaving rock benches above the present stream and gorges or cañons at the steeper gradients.

The Skeena valley, which is broad through much of its upper course, narrows in its traverse of the Coast range. It is there a steep-sided trough, of the same type as the fiord depressions along the coast; but, in contrast to the Fraser, it has not been revived by post-Glacial uplift and, for fully 40 miles from its mouth, is fiord-like. Above this, for 30 miles, the valley is silted up and the stream flows through an alluvial flat. Glacial deposits are found farther up, through which the stream is still actively eroding a channel. In places, however, these deposits have been removed and, for some distance west of the eastern edge of the coast range, the rock floor had been attacked and rock-walled cañons are found, where the steeper grade makes navigation difficult. The mountains in view along this channel do not reach high altitudes; they show the effect of the great glacial stream that moved coastward by this depression.

THE APPALACHIAN REGION.

The mountain system of the eastern portion of the American continent is by no means so imposing a feature as the system of the western region. Through the southeastern United States two parallel chains, side by side, divide the interior basins from the Atlantic seaboard. North of the Hudson river less regularity in form and structrue is found, and the Appalachian system is represented by the Green mountains of Vermont, and the White mountains of New Hampshire. The continuation of the Green mountains into Canada may be traced in the Notre Dame mountains, which approach the St. Lawrence below Quebec and, continuing with more easterly trend, form the highland of the Gaspé peninsula. Over a large part these hills hardly attain

the dignity of mountains, but peaks rising 3,500 feet above the nearby coast are found in the Gaspé peninsula. The continuation of the White mountains is found in the highlands of Maine and New Brunswick, the continuity being shown quite plainly by the rock-folding and other evidences of the great earth movements which caused the topography. An additional ridge apparently forms the present province of Nova Scotia and although the highlands of that province in few places rise to elevations greater than 1,500 feet, the rock structure indicates that it was a mountainous country at no very remote geological period. It is difficult to picture the outlines to which this edge of the continent conformed throughout all the changes of level which have occurred, as throughout a long period of its early history—until the disturbances of Devonian time—land areas were not much in evidence. This period of disturbance was one of those in which the accumulated strains in the crust, due partly to shrinking and partly to shifting of load, were relieved by wrinkling along the front of the continent, forming the early land south of the depression represented by the St. Lawrence. The close of the Devonian period introduces to us evidences, in Gaspé and Nova Scotia, of land deposits containing plants, and we may assume that the present land areas were then roughly outlined, and that surface carving had begun. During the succeeding Carboniferous there was, apparently, a depression of portions of the new land below the sea and a slow recovery, in which probably a much larger land area was formed than at present exists, as is indicated by the occurrence of submarine coal beds.

The great earth movements which resulted in the faulting and folding of the crust appear to have passed their maximum before Cretaceous time and a period of subaerial denudation was then begun. The mountains of the pre-Carboniferous lands and the broken and fractured surfaces of newer date were slowly reduced, the higher ridges to a more rounded outline, and most of the region to a plain of low relief. This period of denudation extending through Cretaceous time had almost produced a mature topography when a revival of the eroding agencies was brought about in early Tertiary times by a general continental uplift. To this second cycle of erosion is due much of the diversified topography of the uplands of the present day. The Tertiary lowlands extend far out beneath the present sea, and the lower parts of the larger valleys, such as the St. Lawrence, Restigouche and Miramichi, like those of the streams of the Atlantic sea-board to the south, were drowned by a general subsidence of the coast before the advent of the great ice-cap of the Glacial period.

A partial recovery of elevation on the withdrawal of the ice-sheet is indicated by the ancient wave-built beaches and marine-clays containing an Arctic fauna that are found along the coasts at elevations of from 50 to 600 feet above sea-level. At Quebec, on the hills behind Château Richer, the highest gravel terraces are 600 feet above tide. On the St. Lawrence shore farther down the river, at Rivière-du-Loup, beaches containing marine shells are found at 370 feet above tide, showing the rising of the land since the invasion of the ice-sheet. At the present time, there is little evidence of any movement of the crust in any part of Canada.

The Appalachian Highlands of Quebec and New Brunswick.

The continuation of the Green mountains of Vermont northeastward through Quebec reaches the shores of the St. Lawrence about 100 miles below Quebec, and continues with a more easterly trend to the end of the peninsula of Gaspe. In Gaspe the range is called the Shickshock mountains, and farther south in Quebec, the mountains of Notre Dame. The altitudes seldom exceed 2,000 feet, and the topography may be said to be almost at a mature stage. The hills are a succession of northeast and southwest ridges cut by a number of transverse valleys. The highlands of western New Brunswick present the appearance of an elevated plateau, which has been extensively dissected, along with the Notre Dame mountains, after the general reduction

of Tertiary times, owing to a late uplift of several hundred feet. It is not definitely known whether the main transverse valleys belong to the earlier denudation or were incised since the elevation of this plateau. The hilltops of this second upland range from 800 to 1,000 feet, a few residual points in the extreme south attaining elevations of 1,500 feet above tide.

The Highlands of Central and Southern New Brunswick.

In the north-central part of New Brunswick, a rough, elevated region, known as the Central highland, stands as an imperfectly reduced part of the great Cretaceous peneplain of the New England States. The region owes its superior elevation to the strength of the granites and gneisses of which it is composed. There is an apparent concordance in level of plateau-like remnants at elevations of about 1,700 feet, above which summits appear up to an elevation about 2,500 feet above the sea. The rock structure is impressed on the topography mainly in northeast and southwest trending ridges and a border or belt of foot-hills of moderate relief carved from the surrounding slates and sandstones. A similar highland at lower surface elevation and of restricted area, is found in the southern part of the province, near the Bay of Fundy.

The Highlands of Nova Scotia.

The greater part of the peninsula of Nova Scotia is underlain by a complex, consisting of granitic masses intruded into highly-folded slates and quartzites that at one time must have formed great mountain masses. This mountainous district, still reflected in the outline of the peninsula, had become reduced to base level by the close of the Cretaceous period, and at present the remains of this old peneplain form the highlands of Nova Scotia. The surface, which is undulating, slopes to the southeast, and instead of sharp peaks the points above the general level are rounded hills and ridges whose summits are only from 600 to 1,000 feet above the sea. An elevation in Tertiary times is responsible for a general re-dissection: and steep, sharply-incised valleys penetrate the higher parts of the plateau, while in the lower parts to the southeast, wide, shallow valleys are more in evidence.

The more resistant rocks once forming the mountainous parts of the Maritime Provinces now form uplands, with the higher summits projecting but slightly above the rough-surfaced plateaus on which they are found.

In a general way these highlands may be considered as forming parts of a sloping plane, which reaches its maximum elevation in northern New Brunswick, 1,700 feet above the sea, descends to 1,000 feet in southern New Brunswick, and is about 500 feet above the sea in Nova Scotia. If, throughout Cretaceous time when the surface was being reduced, the same direction of slope was maintained, it would be reasonable to suppose that lines of drainage would be established bearing a general southeast direction: and it has been proposed as a possible origin for the deep cut made by the St. John river across the hard rocks of the southern highlands, that one of these Cretaceous drainage lines was deepened during the Tertiary uplifts and drowned by the pre-Glacial subsidence.

The Maritime Lowlands.

The denudation of the Cretaceous peneplain during Tertiary time was most complete over the areas underlain by rocks of late Palæozoic age. These, being less resistant to eroding agencies, were rapidly removed, and along the eastern shore of New Brunswick and as far south as the highlands of Cumberland and Colchester in Nova Scotia, a Tertiary lowland was formed in which the topography is mature, the hills have easy slopes and the river gradients are slight.

THE GREAT PLAINS.

A great area, including many diverse features, lies to the east of the Rocky mountains. The portion that is included under the term Great Plains extends from the southwestern edge of the ancient surface forming the Canadian Shield, to the eastern edge of the mountainous region of the Cordillera. This area for long periods was below sea-level; but in its earlier history a large part belonged to the pre-Cambrian continent. To the west there may have been narrow land areas or reefs and into the troughs between was swept the great mass of debris derived from the disintegration of the old pre-Cambrian surface. The amount of material found in the beds representing these early periods of denudation is enormous; and at the time represented by the oldest rocks in which evidences of life are preserved, the land area which formed the western part of the continent had become worn down to an uneven plain such as we now have on the Laurentian plateau. The shifting of the edge of the continental area by the sinking or rising of this old surface can be traced in this area through a part of its history in Palæozoic and Mesozoic time. It seems certain that in early Ordovician time there was an advance of the sea from the Pacific; but in the part of the continent here considered there was a subsidence, and the advance of the sea was from the south. During Cambro-Silurian and Silurian times the sea covered an area reaching from the present mountains to the Winnipeg basin, as well as that now occupied by Hudson bay, the two seas being probably connected by an arm extending through the depression through which the Nelson river now flows. The subsidence during Devonian time carried the sea across to the Arctic by way of the present Mackenzie valley and the whole area under the Great Plains was beneath the sea. A recovery of elevation took place during Carboniferous time, and it is supposed that the sea retreated southwestward leaving a narrow shallow-water channel separating the new land area from the old British Columbia ridge. This received the debris from the new land but in the part underlying the area under consideration no great amounts were accumulated till the beginning of Jurassic time when the coastal disturbances in British Columbia were reflected in the inauguration of another downwarping movement that deepened the trough and admitted the sea from the north across northern British Columbia. The deposits carried to this basin in general went to form fine-grained black shales. Sandstone members appear in the lower parts at intervals, but generally the source of the material is believed to have been at some distance. At the close of the Jurassic, sedimentation became periodically rapid. Sands were washed into the basin and the surface elevation was maintained at or near sea-level, so that continental drainage replaced saline water in the basin. The higher land surfaces that were suffering erosion may have supported a land flora, but no evidence of this remains; the lowland, which was near sea-level during this period of slow subsidence, maintained an abundant vegetation which is consolidated into coal beds of great economic importance.

Mid-Cretaceous time is marked by mountain building, or other disturbances in British Columbia, and the movement eastward of large amounts of coarse material which covered the early forested regions in the lowlands. This was followed by rapid sinking of the crust and the sea advanced to cover nearly as large an area as it had in Devonian time. The western margin was subject to fluctuations; and one retreat of the sea, caused by an elevation of the country to the west, probably reduced the submerged area by half. This period of uplift lasted for a short time only and the sea soon resumed its former size. The close of the Cretaceous is marked by a general, slow uplift and this area rose, to remain above sea to the present time. The new land as it appeared above the sea passed through the first stages of erosion and the newly risen coastal plain, underlain by soft rocks, was rapidly worn away to the harder floor of older rocks beneath. These shore deposits which probably covered a wide strip of the Archean old land to the northeast, were carried back into the shallowing brackish-

water Cretaceous sea and covered the old muds with sand and clay deposits. The material which entered this basin after the salt water of the sea disappeared at the end of the Cretaceous period, was deposited in fresh-water lakes, and in this period—the early Tertiary—a large part of the material deposited consisted of sand and light-coloured clay. Some of the material came from the west shore, originating in the British Columbia highlands; but much of the clay was probably derived from the disintegration of the Archæan rocks to the east.

The plains during early Tertiary times were being slowly elevated. The movement was more rapid in the west than in the east and a slope to the east soon developed. The apex of the elevation, which seems to have been causd by a compressive strain in the outer crust, was in the region of the Rocky mountains, and the continuation of the uplift there developed into great earth fractures and the tilting up of huge blocks in parallel ridges. The debris from this newly-broken surface was probably moved eastward and strewn over the area of the present plains. As the denudation of the plains was also being accomplished, little of this coarse pebble material has remained except the beds found on the top of the Cypress hills and another small outlier on the Hand hills. Assuming that this material represents the debris of the mountain building, the date of this would seem to be about Oligocene time.

Part of the denudation of the Tertiary and Cretaceous beds which had covered the basin with great thicknesses of shale, clay and sandstone, may have been accomplished at this time, especially in the elevated region near the mountains; but the greater part was due to a general elevation in Pliocene times. The amount of material removed may be judged when it is considered that, in horizontal strata, the valley of the South Saskatchewan shows a thickness of 2,000 feet, from the bed of the river to the top of the Cypress hills. Just where the material was ultimately carried it is difficult to say, but it was swept away, a large part probably reaching Hudson bay; and the plains assumed largely their present form.

Many of the valleys of to-day are broad depressions formed in pre-Glacial time, and some of them show old stream gravels covered by boulder clay.

The advance of the ice-sheet was from the north and northeast and the material carried by the ice was spread in a mantle of drift which extended to near the mountains. A general smoothing of the area probably occurred; but in Manitoba the edge of the Cretaceous plateau, which was deeply serrated by easterly-flowing streams, was steepened by the shearing action of the ice as it was deflected southward along the face of the plateau.

The question of the limit of the extension of the ice-sheet westward is still an open one; and the glacial till of the western part is believed by many to have been carried by floating ice. During the closing stage of glaciation the ice front held back large lake-like basins, of which the best known is glacial lake Agassiz which occupied the basin at the eastern edge of the Cretaceous plateau. This lake at first drained southward to the Mississippi. The retreat of the ice front lowered the water; but apparently the melting of the ice relieved the crust and allowed a general rise to the north, so that the lake continued to spill its waters southward over the rim of the basin until another outlet was provided to the north. This is unmistakably shown in the many beaches formed by the waters of the lake at its several stages. The upper beaches, laid down no doubt on an approximately level plain, now rise gradually toward the north. The lower ones, though curved, are tilted in less degree. At Winnipeg the lake, in its highest stage, covered the surface to a depth of 560 feet, and reached westward to near Brandon.

As many of the large drainage channels, such as the Saskatchewan river, were ice blocked during the existence of this lake, a large part of the drainage of the plateau entered the basin by the valley of the Assiniboine river. As a result of the valley cutting which ensued from this increased drainage, a great burden of fine-grained

material was deposited in the lower end of the lake and now forms the fertile land of the Red River plains of Manitoba.

The surface features of the great plains are quite diverse. The general conception of them as a vast area of level, treeless country is descriptive of the southern portion only; and even this portion is not without variety in its topography, since a large part of it is a northeasterly-sloping plateau of Mesozoic sediments, etched into somewhat irregular surface contour and overlapping a lower plain that meets the sloping and irregular surface of the Canadian Shield.

In the belt traversed by the railway lines a threefold division into prairie steppes, rising one above the other, is clearly recognizable, though the divisions are not distinguishable in the region farther north to which the term prairie is not applicable. For the purpose of description in the following pages these three divisions are adopted and a fourth is added for the broken hilly country of the foot-hills.

The first or eastern division comprises the plain lying between the Canadian Shield and the plateau formed of Cretaceous sediments; the second extends from the edge of this plateau westward to the erosion remnants of former Tertiary deposits; and the third stretches from this line westward to the foot-hills. North of the prairie country these distinctions are less noticeable, and divisions two and three become merged into one.

First Division.

The eastern division is the lowest in elevation and in Manitoba and northern Saskatchewan is essentially a region of lakes. It narrows up in the vicinity of lake Athabaska but widens northward to form the lowlands, through which the Mackenzie river flows to the Arctic. The drainage of the southern, narrow part is to Hudson bay, by the Churchill and Nelson rivers. This plain is underlain, generally, by gently-sloping beds of Palæozoic limestone smoothed over by a cover of glacial till. South of lake Winnipeg the till is covered by clays and silts deposited in glacial lake Agassiz. Thus was formed the rich farming land of southern Manitoba, where the extreme evenness of surface is noticeable because of the general absence of timber. This plain is, however, being partly forested by planting and by the natural growth which is taking place now that prairie fires are largely suppressed. The lake basins are due mainly to the removal of Palæozoic rocks from the older, westerly-dipping rock-surface.

In the Mackenzie lowlands the limestone ridges of the Franklin range divide the lower part. The western boundary of the plain southwest of Great Slave lake has not been very definitely fixed yet owing to lack of exploration and the supposed gradual slope from the plateau. The surface does not stand at great elevations above the large lake basins, and the eastern edge, where it joins the rough crystalline rocks of the Canadian Shield, varies in elevation but is highest at the head of Churchill river, where Buffalo lake is given an elevation of 1,330 feet. The slope eastward is gradual, the basin of Cumberland lake on the Saskatchewan standing at 870 feet. Lake Winnipeg, the lowest point on the Nelson river drainage of this plain, is 710 feet above the sea. From the highest point in this division, at the head of Churchill river, the slope north to lake Athabaska is the steepest found along the eastern margin, the descent being about 600 feet. Northward the slope is very gradual, as is shown by the Mackenzie river, which is navigable for steamers from the delta at the Arctic ocean to near lake Athabaska. The fall in this distance (about 1,300 miles) is about 550 feet.

Second Division.

The lower or eastern portion of the Cretaceous plateau is underlain by a succession of shale beds and other equally soft rocks that have been somewhat unevenly carved and cut by stream erosion. It stands at an elevation of about 1,800 feet above

the sea, or nearly 1,000 feet above the Manitoba lakes. The valleys are deeply incised, and one of them, now carrying a small stream, the Qu'Appelle river, at one time carried also the waters of the South Saskatchewan while its northern drainage was blocked by the Keewatin glacier. The drainage of the southern part is eastward into a confluent series of streams entering the Assiniboine valley and northeast into the Saskatchewan. At the edge of the plateau the major valleys are wide and thus divide the escarpment into several prominent hills overlooking the lake plain, known as Pembina, Riding, Duck, Porcupine, and Pasquia hills. Wooded areas occur in the northern part of the plateau and along its outer edge, while a few of the higher levels of the central surfaces are similarly covered.

Third Division.

This area, extending from the Coteau or the hilly country west of Moosejaw to the foot-hills of the Rockies, is divided by the depression through which the South Saskatchewan flows. To the north of this depression the drainage is mainly eastward to the Saskatchewan and northeastward to the Athabaska, while the region to the south includes a fringe of the drainage basin of the Missouri river. There is also, immediately west of the Coteau, a small basin without present outlet, whose waters evaporate in lakes Johnston and Chaplin.

The relief of this division is accentuated by the fact that much of it is bare of trees, so that such elevations as the flat-topped Cypress hills, standing 2,000 feet above the railway near Medicine Hat, and the Hand hills, 800 feet above the surrounding plain, become prominent topographic features.

Fourth Division.

The topographic character of the foot-hills is much more diverse than that of the other divisions. The geological structure is closely related to the topography, and all the hills are formed of folded or faulted rock masses.

Since the folding in these hills is due to the same causes that produced the Rocky mountains, the strikes of the folds follow directions nearly parallel to the mountain chains. Although many of them are of considerable elevation, the summits of the foot-hills are not as serrated as the mountains are, since the rocks composing them are softer. Their flanks, also, are either grassed or clothed with timber. In general arrangement they form a belt of varying width and elevation, consisting of parallel ridges cut here and there by streams rising in the mountains behind. The transverse valleys occupied by these streams are strongly-marked features and are probably ancient drainage lines as, in the outer zone of the foot-hills where the rocks are less folded, the valleys are very broad and the former plateau is represented merely by fragments separating the valleys.

THE ST. LAWRENCE LOWLANDS.

The southern interior of the continent consists of a plain of low relief, bordered on the east by the Appalachian mountains, on the west by the Cordilleran mountain systems, and on the north by the old surface of the Laurentian plateau. To the northeast this plain becomes reduced in width, and in the vicinity of Quebec is represented by a narrow plateau or shelf on each side of the St. Lawrence river. The triangular area beyond, in which is the island of Anticosti, is structurally related to the central lowlands. The underlying rock structures are comparatively undisturbed and represent great periods of deposition that were continued from the Cambrian to Devonian times.

Deposits of Carboniferous times, although not now found, may have originally occupied portions of the southwestern part of the district and have been subsequently removed in the long history of this part as a land area. It is believed that in the lower part of the plain 2,000 feet of beds have been eroded, and evidences of part of this sculpturing is found in the Monteregian hills, a remarkable group of rounded elevations standing as sentinels above the low plain, spaced at intervals of about 10 miles from Montreal eastward to the Appalachian hills. They are found to be ancient volcanic vents and laccoliths and on their surfaces still remain remnants of the rocks removed from the plain. These ancient volcanics indicate lines of weakness or fracturing, and originated, no doubt, during the late Palæozoic disturbances which were marked by igneous intrusion in the country to the east.

The St. Lawrence lowlands may be divided into three sections: (1) the St. Lawrence River plain separated from (2) the Eastern Ontario basin by a point of crystalline rocks, and (3) the Ontario Peninsula, a slightly more elevated plain whose eastern border is a steep escarpment, the eastern outcrop of a heavy limestone bed which underlies the western peninsula.

The St. Lawrence River plain occupies an embayment in the eastern edge of the granites of the Laurentian plateau. It is bordered by highlands on the east and west, but to the south by a belt of irregular somewhat rounded hills which form a connection between the Laurentian plateau and the Adirondack hills in New York. The southern part, from elevations of less than 500 feet, slopes to the northeast to a lower plain which, at Montreal, is 100 feet above the sea. The principal topographical feature of this part is the volcanic group called the Monteregian hills. These vary in elevation from 770 feet at mount Royal, on the west, to 1,755 feet at Brome mountain, on the east. The plain through which these hard rocks protrude is very even and is divided by the deep St. Lawrence channel as far as Montreal. Above this point, the two great rivers, which here meet, are still busily cutting into the rocks beneath and several very picturesque falls and rapids are to be found. On the St. Lawrence the channel is not as deeply or unevenly eroded as on the Ottawa, but is flowing over flat-lying beds so that the descent from lake Ontario is gradual, but the rapids are steep enough to cause exciting navigation in their descent and require the aid of canal locks for their ascent. The surface of the plain, once well forested, is now mainly under cultivation and owes much of its even outline and fertility to the mantle of glacial drift which was distributed while the area was submerged beneath the sea. Since the glacier disappeared the St. Lawrence lowlands have risen in altitude about 600 feet near Quebec, 560 feet at Montreal, and over 475 feet at Ottawa.

The Eastern Ontario basin is underlain by gently-dipping beds that are the lower sediments of the series constituting the Appalachian plateau farther south. This plateau in post-Devonian time emerged from the sea and formed a coastal plain along the south of the Laurentian hills. The erosion of the shore deposits soon developed a belted plain, owing to the unequal hardness of the underlying rocks.

Several of the outer ridges of the early series still remain. The inner ones are now merged into one major ridge, caused by the presence of a heavy limestone bed which has resisted the general erosion; and, in consequence, there has been a deflection of much of the old drainage from down the old sea plain to channels running parallel to the face of this ridge or cuesta, with a resultant intensifying of the erosion accomplished. There is thus a portion of this old sea plain which has been excavated through the softer surface beds, including one resistant member, to a harder series beneath. This excavation in its deeper parts holds the waters of Georgian bay and lake Ontario, while the slope to the old continental shore constitutes the eastern Ontario land area. The western peninsula is the portion between lakes Erie and Huron. In this there is a gentle rise from the lakes to the edge of the Niagara escarpment. The edge of the Appalachian plateau known as the Niagara escarpment is so called from the celebrated falls of Niagara which, in their early history, pitched

over the outer edge of the escarpment, though now, by their erosive action, they have retreated some distance from its face.

The history of the drainage of this area is somewhat obscure; but in its early stages it was probably mainly to the present Mississippi valley or into arms of the sea occupying parts of that depression. An early deflection of some of the eastern streams to a gap in the Appalachians took place, probably, in Cretaceous times and they were later deflected northward into the St. Lawrence valley. The present linking of the lakes into one chain is a further change, as it is believed that the principal line of drainage formerly followed the low ground below the Niagara escarpment; that is, the drainage of the upper lakes was across Ontario to lake Ontario. To the ice mass which covered this part during the Glacial period may also be ascribed some peculiar conditions which are now revealed by the beaches and channels. The weight of the ice no doubt depressed a large part of the surface of the continent and on its removal by melting, the recovery of elevation followed slowly and is shown in the beaches surrounding the present lakes at various elevations. The presence of the ice front also acted as a dam and changed the levels to a great extent. The drainage, when the ice had retreated past the present lakes and before the surface had risen to any appreciable extent, seems to have been divided, the Ottawa valley forming the outlet for the upper lakes and the St. Lawrence valley the outlet for lakes Ontario and Erie. A small elevation of the land closed the Ottawa outlet and for a time, possibly, its waters shifted to an outlet from Georgian bay to lake Ontario. Lake Huron, by the tilting of the crust, gradually extended south and its waters eventually spilled over into the Erie basin through the old pre-Glacial channel which they still occupy.

To accompany, Outline of Physical Geography of Canada, by D. B. Dowling.

Relief Map of Canada

To accompany Physical Geography of Canada *by* O D Dowling

Outlet of Bow Lake.

Photo by M. C. Hendry.

DEPARTMENT OF THE INTERIOR
WATER POWER BRANCH
J. B. CHALLIES, Superintendent.

WATER RESOURCES PAPER No. 2

REPORT

ON

BOW RIVER POWER

AND

STORAGE INVESTIGATIONS

SEASONS 1911-12-13

BY

M. C. HENDRY, B.A.Sc.

Prepared under the direction of the Superintendent of Water-Powers.

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1914

To Field Marshal His Royal Highness Prince Arthur William Patrick Albert, Duke of Connaught and of Strathearn, K.G., K.T., K.P., etc., etc., etc., Governor General and Commander in Chief of the Dominion of Canada.

May It Please Your Royal Highness:

The undersigned has the honour to lay before Your Royal Highness a report of the Bow River Power and Storage Investigations.

Respectfully submitted,

W. J. ROCHE,
Minister of the Interior.

Ottawa, May 22, 1914.

DEPARTMENT OF THE INTERIOR,
OTTAWA, May 22, 1914.

The Honourable W. J. ROCHE, M.D.,
Minister of the Interior.

SIR,—I have the honour to submit a report of the Bow River Power and Storage Investigations and to recommend that it be published as Water Resources Paper No. 2 of the Dominion Water Power Branch.

I have the honour to be, sir,

Your obedient servant,

W. W. CORY,
Deputy Minister of the Interior.

WATER POWER BRANCH, OTTAWA, August 29, 1914.

W. W. CORY, ESQ., C.M.G.,
Deputy Minister of the Interior.

SIR:—Conservation of the waters of the Bow River is of the utmost moment for upon it directly depends the agricultural and industrial prosperity of a very large area of southern Alberta. Rising in the high and remote regions of the Rocky Mountains National Park, and, with its many tributaries, furnishing the most interesting and attractive feature of this world-famed scenic park, it emerges from the park only to be harnessed to supply energy for transmission many miles away to the City of Calgary for municipal purposes, street lighting, tramways, and for general commercial and industrial use. After furnishing this hydro-electric energy, the same waters have, by irrigation, converted thousands of acres of otherwise useless land into the most fertile and fruitful tracts within the Province.

At "first blush" it would appear that the two important uses of this water for irrigation, and for power, would result in serious conflict of interest. Fortunately the irrigation requirements occur during high water stages of the river, and storage on its upper waters would make it possible to conserve enough of the flood flow, not required for irrigation, to equalize the low flow during the winter months that may be necessary for power purposes. The present use and distribution, and the future conservation, of the water resources of the Bow river basin, constitute one of the most important problems before the Department of the Interior. In some of its phases this problem has already been solved, while in others it awaits solution, although a beginning has been made, and the lines of practicable progress have been fairly well marked out.

Realizing the importance of the Bow river waters to every phase of the development of the district through which it flows, and of the utmost necessity of having a practicable conservation scheme worked out and put into practice without delay, the Dominion Water Power Branch has made a thorough investigation of the water resources of the Bow River basin above Calgary. These investigations have been carried on to completion with all reasonable thoroughness and every possible despatch under the immediate direction of Mr. M. C. Hendry, B.A. Sc., who has acted throughout with the continuous advice and assistance of Mr. C. H. Mitchell of the Consulting Engineering firm of C. H. and P. H. Mitchell, Toronto. They have been surprisingly gratifying, showing that it is economically feasible to so regulate the flow of the Bow River, by means of storage works in its upper waters, as to warrant the development at six power sites of over 45,000 continuous 24-hour W.H. P., all within 50 miles of the City of Calgary. At the same time it has been shown, that the using of these waters for power purposes above Calgary need not conflict with the consumption of the same water below Calgary for irrigation purposes; rather would the regulation proposed for power purposes be a distinct advantage to the extension of existing irrigation systems to their ultimate capacity, and also insure in the future the instigation of additional irrigation projects.

Owing to the importance of Mr. Hendry's investigations, and of their direct bearing on the industrial development of central Alberta, I would recommend that they be published for general distribution as "Water Resources Paper No. 2" of the Dominion Water Power Branch.

Mr. Hendry's report is submitted for this purpose.

Respectfully submitted,

J. B. CHALLIES,
Superintendent, Dominion Water Power Branch.

Ottawa, May 22, 1914.

J. B. Challies, Esq.,
Superintendent Dominion Water Power Branch,
Department of the Interior,
Ottawa.

Sir,—I beg to submit herewith the manuscript of a report on Power and Storage Investigations on the Bow River west of Calgary.

In submitting this report I wish to acknowledge the loyal and efficient assistance of Mr. C. H. Attwood, Mr. K. H. Smith, and other members of my staff in collecting and arranging data for this report.

I have the honour to be, sir,

Your obedient servant,

M. C. HENDRY,
Chief Engineer.

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CHAPTER I.

SUMMARY OF INVESTIGATIONS AND SURVEYS.

INTRODUCTION.

The Bow river is a typical mountain river. West of Calgary, it drains an area of 3,138 square miles, of which that part above the Kananaskis falls, 1,710 square miles in extent, may be considered to lie wholly in the Rocky mountains. It has a very steep slope, and in several places falls occur. The head-waters of the river lie at an elevation of about 6,500 feet above sea-level. The flow of the river is typical of all mountain streams, subject to sudden variation and greatly influenced by conditions of temperature. During the winter months the flow is much reduced, but in the hot summer months of June and July the floods occur and the variation between high and low water is very great. While no direct gaugings are available of flood discharges, it has been computed from levels taken by the Canadian Pacific Railway Company at Bow bridge and Kananaskis bridge, that, at Kananaskis falls, just below the mouth of Kananaskis river, a flood of 45,000 c.f.s. has occurred. A low-water discharge of 550 c.f.s. has been recorded at the same point.

What may be termed the power-producing section of the river is a stretch about 30 miles long, well within feasible transmission distance of the logical power market, Calgary. The growth of that city is phenomenal, and as it is the distribution centre for a large district, many small manufactories have located there; others no doubt would follow the advent of cheap power. The city has control of its public utilities, that is street railway, waterworks, electric light, etc., so that it is itself in the market for power in rapidly increasing amounts. In addition to the city, there are other possible customers,—the Canadian Pacific Railway Company have recently erected large car shops near the city; there are also two cement plants, and some plants handling clay products.

Departmental Policy.

The constant growing demand for cheap power for municipal and manufacturing purposes has made the question of water-power development in Western Canada one of vital importance. Fortunately a well-considered and cautious policy of water-power administration has been determined upon, and regulations put into force which afford every reasonable protection to the public in the way of rentals, periodic revisions, control of rates, limited grants, etc., and at the same time foster legitimate private initiative and afford reasonable financial rewards for private skill and efficiency. The Water-power Regulations are set out in full in Appendix V. So far as the administration of the regulations is concerned, it is the policy of the department to afford every possible assistance to the development of water-powers which have any reasonable assurance of economic utilization. In fact, the practice of the department is to carry on sufficient investigations by way of field surveys, etc., as will make it possible for the department to prove the economic features of power possibilities that might be expected to be possible of commercial development within a reasonable time. Such investigations have been carried on throughout the West, but more particularly on those rivers where there are several power sites all within range of immediate use.

It is considered that such investigations should precede the authorization of all important power or storage projects and, furthermore, that proper Government supervision and control of the construction and maintenance of all developments is the only safe method of intelligently initiating construction and maintaining an adequate system of river improvement for power purposes. Such investigation, supervision and control by departmental engineers of recognized competence and character not only secures the scientific treatment of power rivers as a whole, but the safe and economic execution of the various component parts of a comprehensive system of improvement.

Necessity for Investigation.

The Bow river was the first of the Rocky Mountain streams to be investigated by the Department of the Interior as to its power-producing and storage possibilities. The department was called upon to deal with certain applications for power rights on the Bow and on the Elbow rivers; before these could be dealt with in a satisfactory way, it was necessary to have definite and independent information of the situation; this was especially necessary on account of there being overlapping or conflict between several of the applications, as on the Elbow river and on the Bow river at Kananaskis falls.

The growing demand for cheap power, due to the rapid development of the district of which Calgary is the centre, also necessitated steps being taken toward gathering general information on the subject.

It has been shown above that the fluctuation in the flow of the river is great; in order, therefore, that the river might be improved from a power-producing standpoint, some method of regulation and control was necessary. Under natural conditions, the amount of power produced by the river during the six months' period of low flow, would be but a small part of that amount capable of being produced during the remainder of the year, and it was with a view to gathering information in regard to these questions that the investigations embodied in this report were instituted.

Organization and Scope of Investigation.

In April, 1911, the work in the district was organized. The field work was carried on under my immediate direction as Chief Engineer, with the general advice and assistance of Mr. C. H. Mitchell, C.E., M. Inst. C.E.; M. Can. Soc. C.E.; of the Consulting Engineering firm of C.H. & P.H. Mitchell, Toronto, and one of the Board of Consulting Engineers to the Dominion Government, in connection with water-power matters in Western Canada. The work to be undertaken was comprehensive in its scope, calling for an investigation into the power and storage possibilities on the Elbow river, and the Bow river west of Calgary and including all its tributaries. Consequently a reconnaissance of the whole basin was made with surveys of all possible sites and storage basins. In addition, the inspection and approval of plants existing or building in the district was included in the work. Owing to the lack of run-off data at critical points in the river and its tributaries, additional gauging stations were established; this was done by the Irrigation Branch, at the instance and expense of the Water Power Branch. Prior to the work of the Water Power Branch, most of the work of stream gauging had been carried on only during the open-water season, and little data was available as to the flow during the winter months. The former stations, and those established at this time for these investigations were:—

SESSIONAL PAPER No. 25e

Metering Stations—Table No. I.

Stations in existence prior to 1911—
1. Elbow river at Calgary.
2. Bow river at Calgary.
3. Jumping Pound.
4. Bow river at Morley.
5. Devil's creek at Minnewanka.
6. Spray river at Banff.
7. Bow river at Banff.
8. Bow river at Laggan.

Stations newly established.
1. Pipestone creek.
2. Cascade creek at Bankhead.
3. Kananaskis river.
4. Ghost river.

The work instituted in 1911 was continued during 1912, and completed in that year.

The following is a résumé of the work accomplished in the two seasons:—

Reconnaissance.

The reconnaissance of the following was made by Mr. C. H. Mitchell and the writer: Elbow river, Kananaskis river and Kananaskis lakes, Spray river and tributaries and the Spray lakes, Bow lake, Hector lake, Pipestone creek, Johnston creek. Redearth creek, Brewster creek, Baker creek, Forty mile creek, and Ghost river were visited by the writer alone. A reconnaissance, preliminary to the survey on the power-producing portion of the Bow river was also made. The different creeks and lakes examined in these trips were either eliminated as being unsuitable for power or storage purposes, or accepted as feasible and some general scheme for development settled on. In the latter case, a field party was then put on the ground to carry out the investigations in greater or less details.

Surveys.

Surveys were made of the following: Elbow river, between the east boundary of section 14, township 22, range 6, west of the 5th meridian and the north boundary of section 29, township 21, range 6, west of the 5th meridian, particular attention being given to the topography in those portions in section 4, 16, 15, and part of 14, township 22, range 6. During the seasons of 1911-12, a topographical survey was made of about 30 miles of the Bow river from the Canadian Pacific Railway bridge above Kananaskis falls down, particular attention being given to the several power sites. Also topographical surveys were made of Bow lake, lake Minnewanka and the basin of the Spray lakes, with a view to the creation of storage.

Results of Surveys.

The results of these surveys are summarized in the following tables 2 and 3:—

Storage Basins—Table No. 2.

Basin.	Capacity.
Bow lake	27,400 acre-feet.
Spray lake	171,000 "
Lake Minnewanka	44,700 " (created).
" auxiliary	14,200 "
Total above Calgary on Bow river	243,100 "
" " with auxiliary	257,300 "
Elbow river	23,000 "
Total above Calgary, including auxiliary at Minnewanka	280,300 "

Power Sites—Table No. 3.

Site.	Pondage above Dam, in acres.	Head in feet.
Bow river—		
1. Kananaskis falls	122·25	70 (building).
2. Horseshoe falls	98·47	70 (operating).
3. Bow Fort	205·19	66
4. Mission	353·09	47
5. Ghost	786·10	50
6. Radnor	241·50	44
Cascade river—		
At Minnewanka Dam		64
Elbow river—		
Canyon development		215

Results of Storage Investigation.

The effect of storage on the river can best be noted at two points, one of which may be taken as at the Calgary Power Company's plant, at the Horseshoe falls, and the other below the mouth of the Elbow river. At the former site, the effect of all the storage on the Bow above Calgary is noted; and at the second, the effect of the storage on the Bow and Elbow combined. The mean flow for the low-water months, as recorded at Horseshoe falls, has been found to be as low as 745 c.f.s.; by means of the storage that has been, and may still be created, it is anticipated that this can be raised to at least 1,500 second-feet. Below the mouth of the Ghost, this would be increased to 1,600 c.f.s. At Calgary, below the mouth of the Elbow, the storage on that stream becomes effective, and it is expected that a flow approaching 2,000 c.f.s. may be obtained.

The effect of storage upon the power output of the river over that due to the natural flow, may be seen by a glance at the following tables, Nos. 4 and 5:—

Power Output of Bow River—Table No. 4.

Power site.	Natural Flow continuous Wheel H.-P.	Regulated Flow continuous Wheel H.-P.
1. Kananaskis falls	3,820	9,545
2. Horseshoe falls	3,820	9,545
3. Bow Fort	3,600	9,000
4. Mission	2,565	6,410
5. Ghost	3,780	7,275
6. Radnor	2,800	6,400
Total	19,785	48,175

Giving an increased continuous output of 28,390 wheel horse-power.

Summary of Effect of the Storage in the Bow River Basin upon Developed and Undeveloped Water-powers.
Table No. 5.

Proposed Site or Plant.	Natural Flow.								Regulated Flow.						
	Elev. of Crest of Dam.	Working Head. in feet.	Rated H.P. of Turbines installed or proposed.	Min. Mean Monthly Flow in C.F.S.	Available H.P. with Flow in Col. 5.	H.P. Yrs. Available in Average year with wheel Capacity in Col. 4.	Possible Turbine Output 24 hr. power 60% of Time.	H.P. Yrs. Available from water using wheel Capacity in Col. 8.	Min. Regulated Flow in C.F.S.	H.P. Yrs. added within proposed capacity of wheels.	H.P. Yrs. available from Regulated Flow as in Col. 10.	Possible Turbine Output 24 hr. Power 60% of Time.	H.P. Yrs. Available from water with Turbine Capacity as in Col. 13.	Continuous H.P. available with Flow in Col. 10.	H.P. Yrs. added from Storage with Flow as in Col. 10.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
DEVELOPED.															
1. Kananaskis	4,155	70′	11,600	720	4,580	8,887	7,400	6,613	1,500	2,138	7,847	11,110	10,754	9,545	1,698
2. Horseshoe Falls	4,082	70′	19,500	720	4,580	12,087	7,400	6,643	1,500	2,171	7,847	11,110	10,754	9,545	1,698
UNDEVELOPED.															
3. Bow Fort	4,010	66′	*13,200	720	4,320	9,421	6,950	6,262	1,500	2,053	7,407	10,420	10,089	9,000	1,593
4. Mission	3,865	47′	*10,500	720	3,760	7,161	4,930	4,450	1,500	1,493	5,277	7,510	7,260	6,410	1,132
5. Ghost	3,812·5	50′	*10,500	820	3,730	7,669	5,710	5,194	1,600	1,544	6,085	8,420	8,150	7,275	1,188
6. Radnor	3,760	44′	*10,500	820	3,280	7,207	5,345	4,589	1,600	1,375	5,345	7,450	7,210	6,400	1,055

*These capacities provide for an over-development of from 44 per cent to 64 per cent, and are taken arbitrarily; also they provide for considerable load fluctuations.

Cascade River.—
Minnewanka dam.....1,165 wheel horse-power.
Elbow River.—
Canyon site.....3,900 " "

Summary.

In table No. 5, a summary is shown of the effects of storage upon the developed and undeveloped water-powers within the power-producing portions of the Bow river:*

(Note —This table is compiled from diagrams on plates Nos. 20, 21, 22, 23, and 24, and shows the effect of storage upon the river for different assumptions. On plate No. 7 is a profile of the power section of the river. It shows the relation of the head and tail-waters of the different plants to one another.)

Estimates of Cost.

Estimates of cost have been prepared that provide for the complete development of the three storage basins, including one already built—four additional power plants and new duplicate transmission lines sufficient to carry the total output from the four plants, together with adequate receiving equipment at Calgary. While these estimates are preliminary only, and are for the purposes of obtaining a comparison of costs and of arriving at the commercial possibilities of the project as a whole, they have been conservatively computed and it is thought they are ample to cover all contingencies based upon present day labour and market conditions. These are summarized in tables Nos. 6 and 7.

Storage Development.—Table No. 6.

Site.	Capacity Acre-feet.	Estimated Cost.	Cost per Acre-foot.
		$	$ cts.
Bow lake	27,400	105,000	3·83
Spray lake	171,000	514,000	2·98
Minnewanka	44,700	145,000	3·24
" (with auxiliary)	58,900	145,000	2·46
Elbow river	23,000	200,000	8·70

Power Developments.—Table No. 7.

Site.	Head in feet.	Continuous output wheel horse-power.	Estimated cost of plant, including cost of storage.	Estimated cost of power per k.w.hr. delivered in Calgary on 50 per cent load factor basis, including storage, transmission lines, etc.
			$	Cts.
Bow fort	66	9,000	924,970	0·49
Mission	47	6,410	851,100	0·60
Ghost	50	7,275	892,500	0·57
Radnor	44	6,400	807,460	0·59

Note—With reference to the foregoing it may be of interest to note that in April, 1913, a comprehensive report was made for the City of Calgary, wherein it was shown that electric power generated by a steam coal-fired plant and sold on a basis of a 50% load factor, would cost, delivered at generator terminals without transformation or transmission, from 0·85 cent down to 0·74 cent per k.w. hour as the size of the plant increased from 5,000 k.w. to 45,000 k.w. capacity.

SIMILAR INVESTIGATIONS.

Precedents are not wanting for work of the description carried out by the Water Power Branch, either in Canada or in foreign countries. The most extensive work of this kind in Canada has been carried on by the Hydro-Electric Commission of Ontario. In the United States similar work has been done by several of the states in conjunction with the United States Geological Survey; among those that should be mentioned, in which work along the lines of water-power investigation have been carried on are: The states of New York, Maine, Minnesota and Washington.

Ontario.

In Ontario, the Hydro-Electric Commission has investigated a large number of possible water-powers in various parts of the province, and reported upon them. For a number of these, estimates of the cost of development were made in some detail, and are to be found in the reports issued by them at various times. There is a difference, however, between the object of the investigation made by the commission and the investigations here presented; the former were carried on with the object of ascertaining what could be done in the way of power production by the commission, whereas the investigations carried on by the Water Power Branch have been with the object of supplying information to the public on the subject, and procuring information upon which the best administration of the water-powers could be based.

New York State.

The work of the New York State Conservation Commission, which supersedes that formerly carried on by the Water Supply Commission, is rather wider in its scope than that of the Water Power Branch. The work carried on by the Water Supply Commission is now under the Division of Inland Waters of the New York State Conservation Commission; this work is outlined in their reports as follows:—

1. Water storage and conservation for power purposes.
2. Hydraulic development.
3. River improvement.
4. Drainage.
5. Water supply and sewerage.
6. Inspection and supervision of hydraulic structures.

It will be seen from the above that the work is very similar in many ways to that of the Water Power Branch in Canada. With regard to the different sites investigated by them, preliminary plans and estimates have been prepared as has been done in this report.

State of Maine.

The state of Maine Water Storage Commission was established in 1909 under the laws of the state, and consolidated with the state Survey Commission in 1911. An extract from section 5 of the Act reads as follows:—

> "The commission shall also report.....on the present development of the water-powers in the state, with reference to the general plan proposed, so that the legislature may have before it a comprehensive summary of the possibilities that lie in the development of the water-powers in the state as a natural resource, and the necessary steps that should be taken by the state to further increase and conserve them."

According to the second annual report, 1912, considerable progress has been made. This report contains the results of investigations on several rivers of the state, and the conclusions reached; also the records of stream flow and precipitation. The question of power rates is dealt with, a list being published of the principal power producers of the state, together with the output of the different plants, the rates charged, etc.; a valuable article on the cost of power by Mr. Seth A. Moulton, is also included.

In connection with the records of stream flow and precipitation it might be noted that, in all the states where investigations of water storage and power are being carried on, an arrangement is entered into between the state and the U.S. Geological Survey whereby stream gaugings, etc., are made under the direction of the latter, advantage being taken of the experience and highly efficient organization of that branch of the public service.

State of Washington.

The work being carried on by the state of Washington in conjunction with the United States Geological Survey, is under the direction of the state Geological Board. It is similar to that being done by the Water Power Branch, and the results of the investigations to date are set forth in two papers, part I and part II, entitled "Water Powers of the Cascade Range". The field work carried on has been stream gauging in conjunction with the United States Geological Survey, and the surveys of the rivers and lakes to determine the possibilities of storage and power; these surveys have been more in the nature of a reconnaissance than in detail, the purpose being, to quote from the report, "to show the power resources of the basins described, and to indicate in a general way the relative value of the individual power privileges."

Other Examples.

In this connection it might also be mentioned that there are certain rivers that have been developed by private interests. One notable example of this is in Massachusetts, on the Deerfield river (see *Engineering Record*, February 1-8-15, 1913). This project is mentioned on account of its close resemblance in many respects to the Bow river project as to head, discharge, and storage development; the plants operating under the lower heads, namely, at Scott's bridge, Shelbourne falls, Bardwell's bridge, upper and lower plants, are practically the same as those on the Bow, built and projected as described in this report, and the flow of the stream is of nearly the same volume, so that the power output of the plants is approximately the same as for those proposed on the Bow river.

To compare the two projects, a partial list is here given of the plants on the Deerfield river taken from the *Engineering Record*, February 1, 1913. See Table No. 8.

Plants on the Deerfield River, Mass., U.S.A.—Table No. 8.

Plant.	Average net head.	Normal water sec.-ft.	Installed capacity K.W.	Poundage 4-7 flash board Ac.-ft.
Scott's Bridge, Plant 4	64	1,350	6,000	400
Shelbourne's Falls, Plant 3	64	1,350	6,000	160
Bardwell's Bridge, Upper Plant 2	58	1,480	6,000	400
Bardwell's Bridge, Lower Plant	40	1,500	4,000	
Stillwater Bridge	40	1,500	4,000	
Total			26,000	

Note.—There are other plants in this system but they are omitted, being of higher heads.

The storage in this project is developed at two points, one basin having a capacity of 2,500 million cubic feet and the other 4,500 million cubic feet, or a total of approximately 161,000 acre-feet, 10,000 acre-feet less than the capacity of the Spray lake basin herein proposed.

Recommendations.

In a letter published as an appendix to this report, Mr. C. H. Mitchell, C.E., consulting engineer on these investigations, has made certain recommendations in regard to the further carrying out of the work instituted; also as to the operation and control of the works proposed; a summary of these recommendations are here given:—

1. That the investigations on the Bow river basin be continued for the purpose of making the data more complete and useful in the subsequent operation of the project.
2. That the Government undertake the further construction of storage reservoirs and regulating works and provide for the repayment of their cost by means of annual rentals charged to users of water.
3. That a scheme for operating these storage reservoirs and for regulating and controlling the discharge of the river be adopted and put into practical working effect by the Government, and that the annual cost of same be charged to the users in the same manner as the original cost.
4. That as soon as this project is put into working effect, or sooner, the existing storage works at lake Minnewanka should be acquired and their regulation and operation be taken over by the Government according to the terms of the existing agreement with the power company.

Acknowledgments.

Acknowledgment is here made for information placed at the disposal of the branch and embodied in the report.

To Mr. F. H. Peters, Commissioner of Irrigation, also to Mr. P. M. Sauder, Chief Hydrographer of the Irrigation Branch, Department of the Interior, for stream flow and other data for the district.

To the Calgary Power Company and its officials for hearty co-operation and for information relative to the discharge of the Bow river, plans, cost data, etc.

To the city of Calgary for information bearing upon the power market.

Acknowledgment is also made for meteorological records and data made use of in this report and placed at the disposal of the Water Power Branch by the Meteorological Service, Department of Marine and Fisheries.

In compiling the report, the works of many authorities have been consulted; these are acknowledged and references given where quoted.

CHAPTER II.

BOW RIVER.

General.

The portion of the Bow river dealt with in this report may be generally described as that part lying west of Calgary, and including Elbow river which forms a tributary of the Bow and joins the latter stream within the city limits of Calgary.

The Bow river has its head-waters on the main continental divide and flows in a general south-easterly direction, roughly paralleling the summit of the mountain ranges for the first hundred miles of its course. On account of this, the main stream and many of its tributaries have their sources at high altitudes and are, to a very great extent, glacier fed. (See reproduction pages 1 and 12.)

Fall.

From the head-waters to Kananaskis falls, at the confluence of the Kananaskis and Bow rivers, a distance of about 90 miles, the fall is about 2750 feet. From Kananaskis falls to Calgary, at the junction with the Elbow river, a distance of about 55 miles, the drop is 720 feet.

Drainage Area.

The drainage area of the Bow river above Calgary is 3,138 square miles, exclusive of the area drained by the Elbow river. Of this area, 1,710 square miles lie above Kananaskis falls and may be considered as lying entirely within the mountains. The remaining 1,428 square miles are in the foot-hills, and this section extends as far east as Calgary.

Discharge.

The discharge of the Bow river varies greatly from season to season. The flow during the high-water period, which occurs during the summer months, being many times that of the low-water period, the latter occurring during the winter months. The great variation is the main drawback to economical power development on the river.

Records of the discharge of the river at various points have been kept more or less continuously since 1909. From these a diagram has been drawn (see Plate No. I.), which shows the discharge of the river as recorded at Banff, Horseshoe falls and Calgary.

Topographical Features.

From Bow lake, the source of the river, down to Laggan, the river flows for the most part through a wide valley. In this section the banks of the stream are low, and the flats themselves are in many places very swampy, so much so that, in any but very dry seasons, it is necessary to keep to the high ground along the shoulder of the mountains when traversing the valley.

Below Laggan, as far as Kananaskis falls, the valley traversed is wide, flat, and covered with gravel; the stream is tortuous in its course, the banks being low and dry. In two or three places in the main valley above Banff, small lakes occur, probably formed by the damming off of part of the old river course by

BOW RIVER

Diagram shewing Mean Monthly Discharge from Jan. 1908 to Dec 1912
AT
CALGARY, HORSESHOE FALLS, AND BANFF

To accompany report on Power and Storage Investigation
By M C Hendry, B A Sc

Commissioner Consulting Engineer
M. C. Hendry Chief Engineer

Legend
Discharge at Calgary shewn
" Horseshoe Falls "
" Banff "

Mean Monthly discharge in Second - Feet

14000 13000 12000 11000 10000 9000 8000 7000 6000 5000 4000 3000 2000 1000 0

NOTE - Mean Discharge for partial Months shown by dotted lines

Jan Feb Mar Apr May June July Aug Sep Oct Nov Dec

1908 1909 1910 1911 1912

material carried down from the surrounding mountains. Below Banff, near Exshaw, the river widens out and covers the greater part of the valley.

At Kananaskis falls an abrupt change in the topography of the country takes place; this, it may be said, is due to the fact that the river leaves the mountains proper here, and flows out into the foot-hills. These conditions may be said to continue as far as Calgary.

Divisions of the River.

For purposes of description, the part of the river lying above Calgary will be divided into two parts, exclusive of the Elbow river, which will be dealt with separately. The upper part of the river lying above Kananaskis falls will be referred to as the storage section of the river, while that part lying below Kananaskis falls and as far down as the city of Calgary will be referred to as the power-producing section.

Power Section of the River.

From Kananaskis falls nearly to Calgary, the river flows through a wide valley for long stretches; the river proper is confined, however, to its channel by steep banks that at different points are rocky cliffs of considerable height, running as high as from 100 to 150 feet. Generally these cut banks have long sloping banks opposite to them, but in places the river channel is canyon-like for short stretches, lending itself to power development and hence the designation.

This topography is generally typical of the river, from Kananaskis falls to Calgary.

Storage Section of the River.

The storage section of the river, a stretch of approximately 90 miles in length, lies to the west of Kananaskis falls, and entirely in the mountains. The Bow river rises at an altitude of 6,860 feet above mean sea-level; Bow lake, which is practically its source, lies at an altitude of 6,420 feet, and offers the first and highest site for storage in the Bow basin. About 12 miles below Bow lake, Hector lake, which is at an elevation of 5,700 feet, empties into the Bow. (See reproduction page 14.).

From Hector lake to a point near Laggan, a distance of 15 miles, the river falls about 650 feet, or about 43 feet per mile. About 2 miles above Laggan, it is joined by Bath creek from the west, and just below Laggan, by the Pipestone creek from the north. Between the outlet of Hector lake and Bath creek, a number of small streams join the Bow, but on account of the smallness of their discharge during cold weather, they are not worthy of notice.

Between Laggan and Banff, a distance of 35 miles, the river falls 540 feet, approximately 16 feet per mile. The river valley is very wide in this section, the banks of the river low and the stream swift-flowing; there are no distinct drops, what is practically a continual swift exists between the two points. In this stretch the volume of the river is augmented on the south side by the waters of the Chalet creek, the outflow of Moraine lake, and the waters of Vermilion, Redearth, and Brewster creeks; there are also many others, which are too small for notice as they have no discharge during the low water or winter season. On the north side there are several creeks of importance—Pipestone, Baker, Johnson, and Fortymile being the largest. All of these creeks are short, and rise at considerable elevations; those entering from the south side commence on the main divide, and have their source, for the most part, in the glaciers to be found along the summit of the mountain range. (See reproduction page 12.) The creeks entering from the north are longer, and their slopes are not so steep, although their sources are at considerable elevations, ranging from

7,500 to over 8,000 feet above mean sea-level. These streams are not fed by glaciers to the same extent as those entering from the south, but derive their flow mostly from the yearly fall of snow which is melted during the hot summer months; their discharge is therefore greatest during hot weather, and is greatly effected by the temperature conditions.

Photo by M. C. Hendry.

Crow Foot Glacier.

Photo by M. C. Hendry.

Bow Glacier.

From Banff to Kananaskis falls the nature of the topography is not materially changed, except that the mountains are generally lower, the valley is wider and the river more meandering. Between these two points the fall is 380 feet in a distance of 30 miles, about 13 feet per mile, and some of this occurs as a direct fall at the Spray falls in Banff, at the beginning of the section. Three streams of importance add their waters to those of the Bow in this stretch of river: the Spray, entering from the south at Banff, just below the Spray falls; the Cascade, which also forms the outlet of lake Minnewanka, enters from the north, about 4 miles below the mouth of the Spray; the Kananaskis, joining the main stream from the south, just above the falls of the same name.

The important streams contributing their waters to the Bow river will be dealt with in greater detail in another part of the report, merely their location relative to the main river being given here.

Lakes of the Storage Section.

Nearly all the streams flowing into the Bow river have, at or near their source, a lake of greater or less size. Those belonging to the first class are Bow and Hector lakes, already mentioned; lake Minnewanka, Spray lakes and Kananaskis lakes, the last two forming part of the water system of the same name. Amongst the other lakes belonging to this basin that might be mentioned is lake Louise, its outlet is Chalet creek; this lake is famed for its beauty the world over. Then there are Ptarmigan and Baker lakes at the head-waters of Baker creek, also Redoubt lake on the same stream; Moraine lake, another lake of great beauty in the valley of the Ten Peaks, which empties into the Bow by way of a stream of the same name; Boom lake, at the head of Vermilion creek, and Shadow lake forming one of the sources of Redearth creek. These lakes may be termed storage basins, and have the effect of regulating, to a considerable extent, the streams to which they belong.

Stream Beds of Storage Section.

The mountain streams in this district all have the same characteristic bed. In very few instances does the river flow over bare rock, and then only for very short lengths of the stream; generally speaking, this condition is to be met with upon the tributaries and only in places where the stream passes through a canyon. With these exceptions the river and stream bottoms may be described as being composed of gravel and detritus, which overlies the rocky bed of the streams to a depth of many feet. In some places the bed of the river is in the nature of a large gravel flat where, during the low water period, the river will generally follow a number of small channels; these channels are continually changing; during the high-water period the entire flat may be covered.

The material forming the river bed is transported from point to point during the high-water periods, and deposited in pockets behind the rocky ridges extending across its path, as bars and shoals. The greater part of the main river channel has been formed in this way and also the channels of the tributaries. In many places the whole valley has become filled for a width of several hundred yards, and on the Bow river these are, in places, of very considerable area. (See reproduction page 14.)

Underflow.

The nature of the river beds, formed as they are by gravel and detritus overlying bedrock is very favourable to underflow. There is no doubt that in these mountain streams, the underflow forms a very considerable portion of the

natural discharge of the river, but the relation which it bears to the surface flow must necessarily vary, and will depend to a large extent upon the slope of the stream and the depth to which the bedrock is covered by the porous material forming the stream bed.

Photo by M. C. Hendry.

Bow River below Hector Lake.

Photo by M. C. Hendry.

Ghost River Flats.

During the high-water period the underflow is relatively small, but during the low-water period, which corresponds to the winter season, the underflow may be expected to form a very large proportion of the discharge, and in the smaller streams there is no doubt that at times it forms the total flow. This underflow has a very considerable effect upon the results of gaugings made in the streams, causing results to be obtained which do not truly represent conditions.

CHAPTER III.

ICE.

One of the problems which confronts the engineer in the design of a water-power development in Canada is the method to be adopted for eliminating or minimizing the effect of ice upon plant operation and power production. The effect of the ice upon the present plants in operation upon the Bow river is not a direct one; so far no great trouble has been experienced in operating the plant due to ice blocking the water entrances, nevertheless the presence of ice in the river has a marked effect upon the power production, and it cannot be overlooked in the study of any future development.

Before looking into the effect of ice upon the operation of a plant, it will be well to examine the formation of the ice itself, and by this means aim at a possible method of dealing with the question.

There are three kinds of ice which, owing to their effect upon the operation of water-power plants, are of interest to the engineer; these are,—board or sheet ice, frazil ice and anchor ice.

Sheet Ice.

Sheet ice is that kind of ice which is formed upon the surface of lakes, smooth-flowing rivers, ponds, etc. The process of formation is an interesting one, and begins with the arrival of cold weather. As the season advances, the water on the surface gives up its heat by surface radiation, convection currents are set up, the cold surface water falls and the warmer water below rises; this in turn gives up its heat; by a continuation of this process, the temperature of the whole body of water is gradually lowered until it reaches 39° F.; at that temperature convection ceases, and the water on the surface is cooled down until freezing point, 32° F., is reached. The first indication of the formation of ice is the presence of long needle-shaped crystals on the surface, these rapidly increase in number and size until finally the whole surface is covered; this surface layer becomes more compact, and the ice increases in thickness, as the underlying water gives up its heat by conduction through the ice; the rate of growth diminishes, however, as the thickness of the sheet increases.

When the ice sheet is once formed, radiation to a very great extent ceases; this is due to the fact that the ice is seldom clear, and is generally snow covered and the heat rays are unable to penetrate under such conditions; if the ice was clear and solid, the heat rays could then penetrate, and the loss of heat from the water below would go on at a much more rapid rate, and consequently the growth of ice would be more rapid.

The presence of any sheet ice in a river immediately above a power plant has a beneficial effect upon its operation rather than the reverse; the reason for this will be understood after the subject of frazil and anchor ice has been dealt with.

Frazil Ice.

Frazil ice, known also as "slush ice," is perhaps the ice formation which has the most serious effects upon water-power operations. It is always formed in the open channels where the current is too swift or turbulent to allow the formation of sheet ice, and its formation is dependent upon disturbance or

agitation, consequently swift turbulent streams are very prolific in its production; it occurs in needles, the fineness of which are due to the amount of agitation; in such places as rapids, and at the foot of falls, these needles are very fine, but they increase in size and thickness where the flow is less rapid and disturbed. Frazil ice is always surface formed, but the ice crystals rapidly become distributed throughout the whole body of water; this gives rise to the saying that the water is "thick." This condition occurs only during a period of extreme cold, combined with great surface agitation, due to rapids in the river, or wind; the direction of the wind relative to the flow of the river has a varying effect on production of frazil, a wind blowing upstream produces more frazil than one blowing downstream, on account of increased surface agitation.

The conditions that make for the greatest production of frazil ice are a dull stormy day, with wind upstream; a great amount of frazil may be produced upon a clear cold night with wind, but on a clear cold day with wind there is not so great a quantity formed, due to the absorption of heat from the sun's rays at the water surface. Professor H. T. Barnes, in his book on "Ice Formation" says that: [1] "A stretch of open water makes a very much greater quantity of ice in the form of frazil crystals than could be produced as a surface sheet, if the water were sufficiently quiet to allow such to grow." It is this production of frazil which gives rise to so much trouble, the stream becoming blocked with the mass. Where an ice sheet exists, conditions are often aggravated, the frazil blocking the waterway underneath, at times causing complete stoppage of flow.

Anchor Ice.

Anchor ice, "ground ice," the German name "Grundeis" and the French-Canadian term "moutonne" are among the many names given to this particular form of ice. As this list of names would indicate, it has attracted very widespread attention, and a number of scientists have published papers in which its formation has been discussed. The name "anchor ice" perhaps best describes it, and is the one by which it is most widely known in this country.

The peculiar feature which gives it this name is the fact that it is formed upon the bottom of the rivers or streams. Many theories as to the reason of the formation of ice upon the bottom have been advanced. That as set forth in a paper by Rev. Dr. Farquharson, which he published in 1835 and 1841, and quoted by Dr. Barnes in his work [2] is generally accepted as the correct one. He attributes the formation of anchor ice to the radiation of heat from the surface of the stream's bed.

It is remarked that this cooling by radiation, and consequent formation of anchor ice, occurs only in streams whose beds are composed of gravel, stones and boulders, but not in clay or mud-bottomed streams; also that the formation of the ice is greatest on the rocks and stones of dark colour.

The formation of anchor ice is most rapid during a clear, cold night (conditions which are favourable to rapid radiation). On a clear, cold day, the sun's rays affect the formation; in fact, it is universally noted that on the appearance of the sun in the morning, the ice becomes loosened from the botton and rises to the surface; its appearance when floating has given rise to the French-Canadian term, "moutonne," on account of its resemblance to the backs of white sheep.

It has been noted in connection with anchor ice, that its formation does not occur under cover; a bridge spanning a stream retards radiation and prevents its formation, and it is seldom found where the stream is covered with an ice sheet.

(1) Page 105, "Ice Formation," by Prof. H. T. Barnes.
(2) Page 108, "Ice Formation," by Prof. H. T. Barnes.

The names frazil and anchor ice are often confused and are frequently used as being interchangeable; the term "anchor ice" being used to designate ice found attached to the bottom, regardless of the method of formation.

Professor Barnes says that:[1] "In a shallow, smooth-flowing river, we are more likely to have anchor ice formed in excess, whereas in a deep and turbulent stream we are likely to have more frazil. It is hardly likely, however, that there will be a great difference in the amount of frazil formed in either case; it will probably be that more or less anchor ice will appear in proportion."

The Montreal Flood Commission in their report deal exhaustively with the question of ice formation. The following is an extract from that report:—

> "The terms 'anchor ice' and 'frazil ice' are indifferently applied to the same material, but the first evidently is most applicable to this ice when found in the bottom of the river. In one respect the two are identical, that is, both are exclusively the production of open water. There is no formation of either when or where the surface is covered with ice, and whereas large formations of both take place in the beginning of winter over the vast surface below Lachine rapids, the further formation of this ice ceases as soon, and whenever the ice-bridge is formed. Frazil, as distinguished from anchor ice, is formed over the whole unfrozen surface above and below Lachine rapids, between Prescott and the tide-water and wherever there is a surface current or wind agitation to prevent the formation of bordage ice, while anchor or anchored ice, except in the shallowest portions of the current, does not appear in the deeper water until zero weather sets in."

In this report the formation of anchor ice is not ascribed to radiation from the river bottom, but rather to the cooling of its surface through the contact with the frazil-charged water. Proceeding with the description on anchor ice, the report says:—

> "On the approach of mild weather, it becomes detached from the bottom, sometimes bringing up with it gravel and stones, and may be seen as a dark-coloured mass bursting up all over the surface with considerable force, and with a hissing sound, which rises a foot or more above the surface, but, falling back, shows only a few inches floating above it. Out of the portion above the surface, the water quickly drains, and it becomes white as snow."

This is the appearance giving rise to the term "moutonne" mentioned before.

In respect to the name "anchor ice" being applied to frazil ice, this is due, in the case of water-power developments, to the action of the frazil under certain conditions. Where the head-race of a development is open, allowing the frazil direct access to the intake without having to pass under an ice sheet, it practically becomes anchor ice, because as it comes in contact with the racks and intake structure it adheres to them and rapidly cuts off the water; under these conditions there is no difference between anchor and frazil ice, once the latter has become attached to the structures. As a matter of fact, it is this action of the frazil which causes the trouble directly to plant operations, as it is generally formed in the greatest quantity. The action of the anchor ice proper is to cut off the flow of water in the stream bed; when the anchor ice is floating, the conditions are improving.

Winter Conditions.

One condition which requires attention in a study of this kind is the effect of ice upon the discharge of the river, for the formation of frazil and anchor ice in the bed of these rivers and streams has a very marked influence upon their

(1) Pages 110-111 "Ice Formation," by Prof. H. T. Barnes.

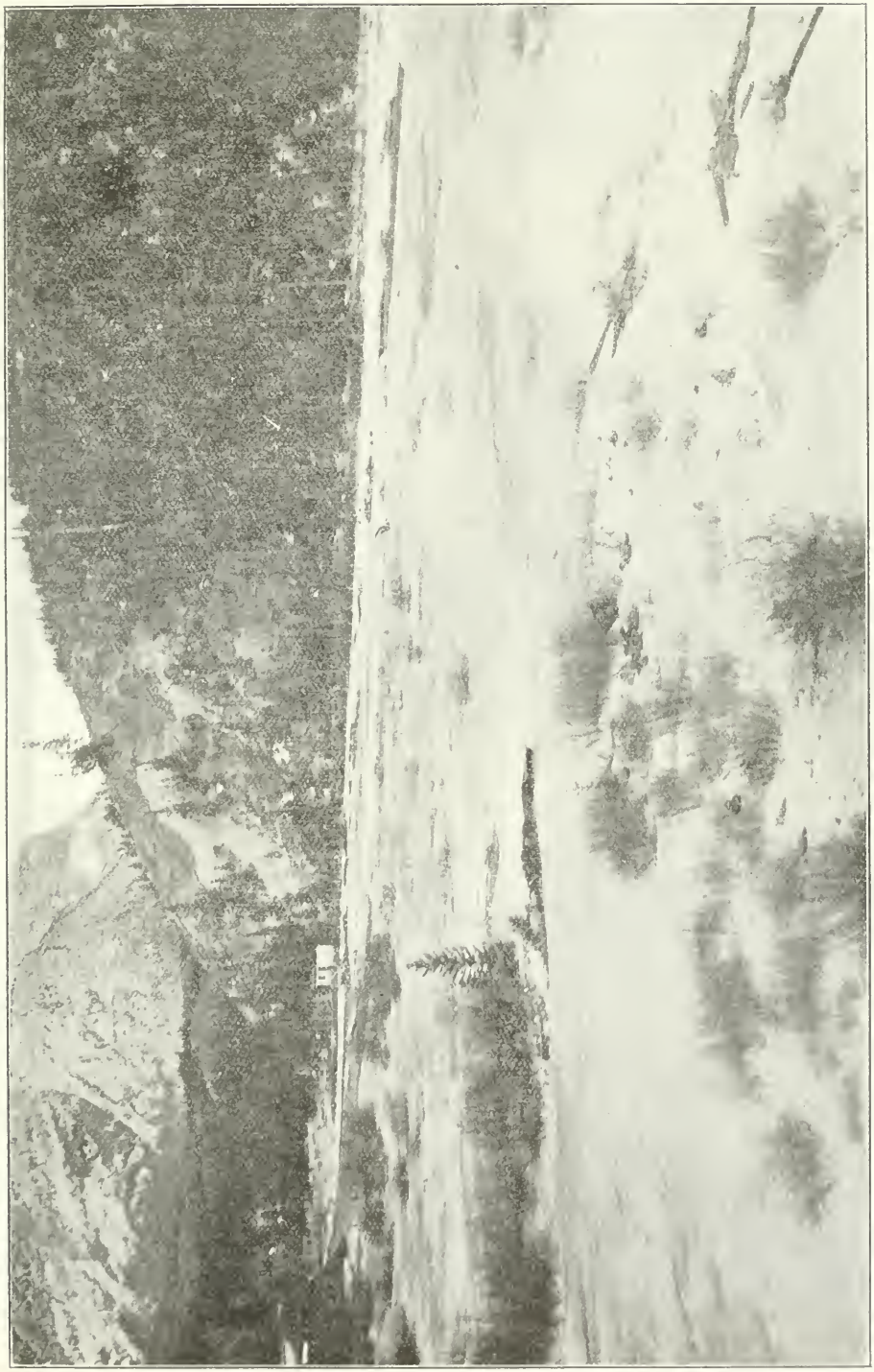


Photo by M. C. Hendry.

Ice Conditions—Cascade River.

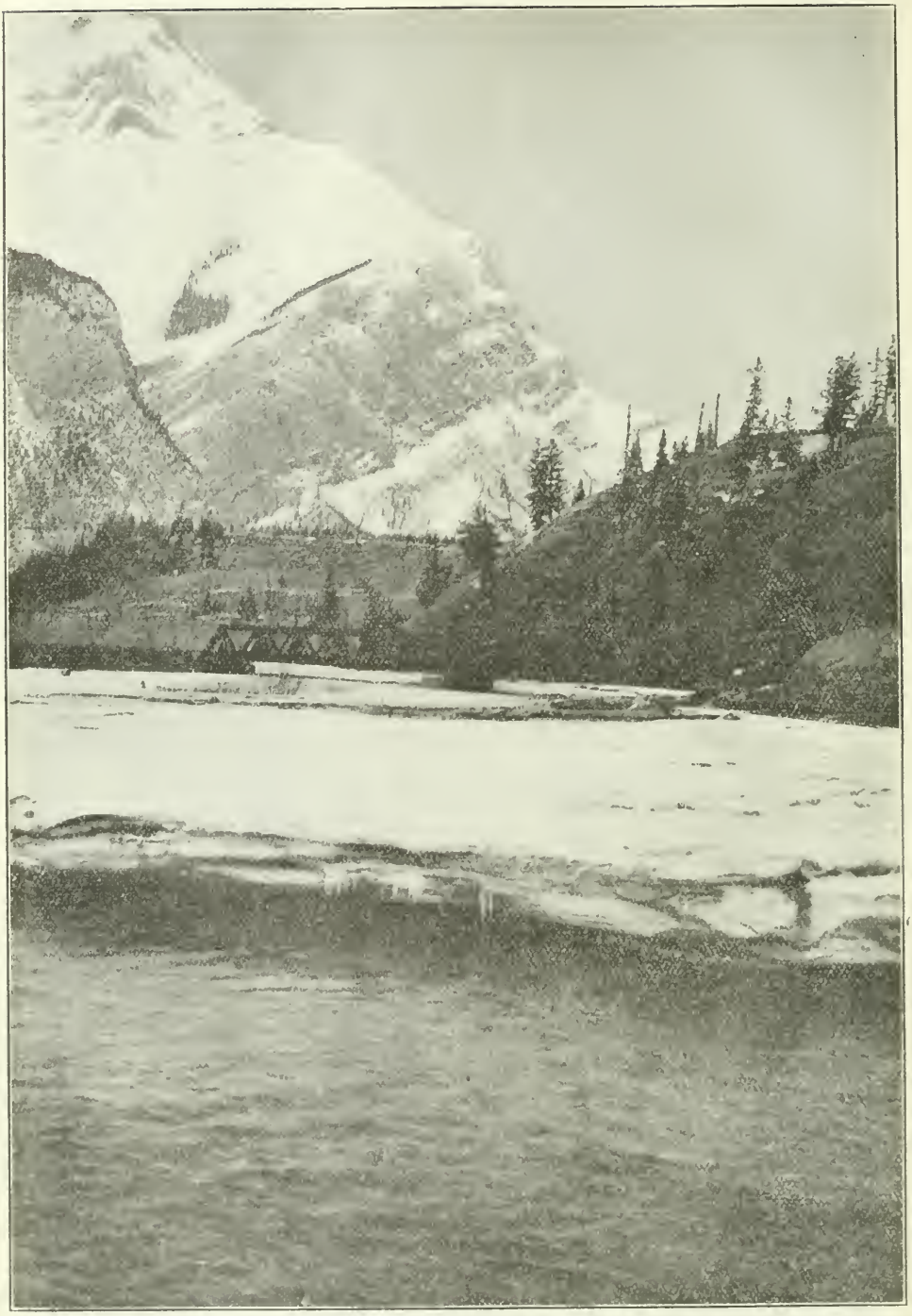


Photo by M. C. Hendry.

Ice Conditions—Cascade River.

discharge. Lying, as they do, at considerable elevations, the temperature obtaining during the winter months is low and, owing to the steep slope of the streams, their flow is turbulent, thus the necessary conditions are present for the formation of frazil ice. The conditions for the formation of anchor ice are also good, for in many places the stream is too swift to allow an ice sheet to be formed; the water is clear and generally shallow, the nights are cloudless and cold; in consequence anchor ice is formed in great quantities.

The formation of frazil and anchor ice in the mountain streams causes their discharge to be very fluctuating, and accentuates the variation in flow during the low-water period.

Winter Conditions as Affecting Plant Operation.

The successful operation of a water plant in winter, on the rivers of Canada, depends in a large measure on the method of providing for or eliminating the ice troubles which are always to be met with.

In the foregoing, the conditions favourable to the formation of the several kinds of ice to be met with have been explained, also the relation of one kind of ice encountered, to another. Of the three principal kinds, sheet or board ice is the least detrimental to operation: in fact if board ice were the only kind to be dealt with, the trouble would be negligible. Where the channels are small, however, and where anchor and frazil have been formed above, great trouble may be experienced, due to the lodging of this frazil and loosened anchor ice, under the sheet, for frazil ice, in the presence of sheet ice, attaches itself to the under side of the latter, and where the channels are small, the whole flow of the stream may become blocked, overflow will then occur and a great proportion of the stream flow be lost. (Reproductions pages 19, 20, 24 and 25, illustrate these conditions.)

One of the best methods, however, of avoiding frazil and anchor ice troubles, is by obtaining a pond of sufficient size and depth in the immediate vicinity and above the intake of the plant, which will readily freeze over; the ice sheet obtained will, to a great extent, eliminate any troubles with frazil or anchor ice.

If the entrance to the power plant is a channel restricted in size, the ice sheet will be a hindrance, rather than a benefit, if there is open water above. In such a case it is much better to be without a sheet of ice, and instead make provision for handling the accumulation of frazil and anchor ice in the head works. There have been many attempts made to deal with this problem, but it generally degenerates into a brute force combat. In many plants provision is made for passing masses of frazil ice through the wheels by raising the racks in sections, currents are then induced to pass across the face of the racks, so that the floating ice, etc., may be carried off.

The great trouble with frazil ice is due to its freezing on the racks and the wheels, finally stopping the supply of water. With regard to the racks, this has been usually due, in a large measure, to the fact that the upper ends of the bars composing them have been left protruding above the water for 2 or 3 feet exposed to the very cold air: in such a position these bars become chilled to the bottom, and even when only cooled to two or three one-thousandths of a degree below freezing point, it is sufficient to cause the frazil ice to adhere to the bars and commence the clogging process. This trouble may be eliminated to a great extent by making the upper part of the rack of wood, and keeping the metal bars entirely submerged, thus preventing the conduction of heat from bars to the atmosphere, and the consequent cooling below freezing point. Besides this method of submerging the metal of the racks, schemes have been brought forward for heating them, such as using hollow bars through which steam may be driven. In many plants instead of this, the head works are housed and heated, not only to provide a good working room for the men fighting the

ice, but also to prevent the subcooling of the racks. One of the most successful schemes has been that employed by one of the plants in Ottawa; there the tops of the bars are encased with sheeting, steam pipes being also enclosed; by this means ice troubles have been prevented to a great extent. The use of a live steam jet in the wheel case and guide vanes to prevent the freezing or clogging up of the wheel entrance has been quite successful in several plants.

CHAPTER IV.

METEOROLOGICAL PHENOMENA.

RAINFALL.

General.

The importance of a study of precipitation in connection with the flow of streams cannot be emphasized too much; its influence on stream flow is a very direct one and, without study, the erroneous conclusion is reached that the relation between precipitation and run-off is a simple one. A little time spent in the study of the question soon reveals the fallacy of this assumption, for the relationship is anything but simple, being influenced by a great many physical features of a rather indeterminate nature.

The collection of precipitation data all over the country has been carried on for a comparatively long term of years, whereas data regarding the run-off of streams are rather meagre; if, therefore, some general relation can be established between rainfall and run-off, the study of the streams from the standpoint of power production can be placed upon a more satisfactory basis. In the West, and particularly in that part of the eastern slope of the Rockies in which we are interested, run-off data have been collected for a very short term of years, and only during the last three has a continuous record of the discharge been kept; thus the importance of a general relationship between recorded precipitation and run-off is all the more apparent.

The distribution of rainfall in any district or part of the country is not uniform. The records throughout Canada, generally, except in the eastern provinces, do not extend over a sufficiently long period, nor are the stations widely enough scattered to define areas in which certain amounts of rainfall may be expected. In the West, an examination of the available records seems to indicate a general conformation to conditions found to the south, in the United States; that is, that the lines of equal rainfall are generally north and south, or roughly parallel to the mountain ranges; there are of course divergences due to local influences.

Relation of Precipitation to Altitude.

Generally speaking, precipitation decreases with the increase in altitude; it has been found in travelling westward away from the Atlantic that as the country rises, the rainfall decreases. This general rule, however, does not seem to apply to the particular case we are studying, namely, the precipitation in the valley of the Bow river; in fact, the direct opposite is apparently the case both here and in practically all the territory forming the eastern slope of the Rockies. An examination of the records will show that as the altitude increases on the eastern slope, the precipitation increases; special local influences are at work here, however, the mountain ranges in which are situated the sources of the rivers, causing this reversal of the general rule.

The warm, moisture-laden winds from the Pacific are first intercepted by the mountains of the Coast range and deflected upwards to mingle with cold air currents or to come in contact with land at a lower temperature; becoming chilled below the temperature of saturation, they deposit some of the moisture

as snow or rain as they pass over the mountains, giving rise to the heavy precipitation near the coast, the greatest recorded on the continent. They then pass over a stretch of low-lying land, depositing but little moisture until the Selkirk range is reached, where the process is repeated. When the Rocky mountains are reached the humidity of the air has become much reduced, but the low temperatures reached at the higher altitudes is sufficient to cause more precipitation; therefore, in the Bow River basin, with which we are dealing and which is on the eastern slope of the Rockies, it is at the higher altitudes that the greatest precipitation occurs. The alternation of mountain ranges with stretches of country of low altitude is accepted as the cause of the arid and semi-arid regions to be found to the east of the continental divide.

Value of Records.

In making a study of rainfall in any district, it should be borne in mind that the average precipitation gives only a relative view of the question, as great variation from the average annual precipitation may occur at different points in the district. In this regard no general law can be made to apply; the number of conditions contributing are so great and variable that, for special purposes, a detailed study of the rainfall in the locality is necessary.

When studying precipitation records extending over a given period, it is necessary to know what value may be attached to them. Sir Alexander Binnie has given this question careful consideration in a paper published in the proceedings of the Institution of Civil Engineers, vol. 109, pages 89 to 172. He reached the conclusion that for records extending over a period of twenty-five years, the mean obtained would be within 2 per cent of the true mean. The conclusions reached by Mr. Rafter in a discussion of this paper were: that, for a period of five to ten years, the probable extreme difference from the mean would be 15 per cent, and of ten to fifteen years, 4.75 per cent. Other authorities have expressed the opinion that it is necessary to have records for a period as great as forty years in order that the mean may represent the true mean precipitation within five per cent.

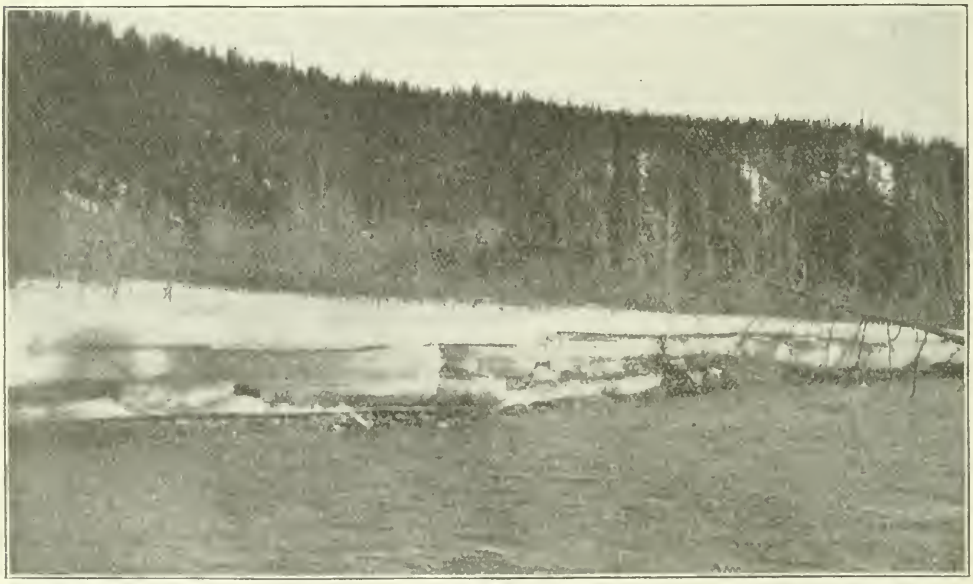


Photo by M. C. Hendry.

Ice Conditions—Cascade River.

Accuracy of Records.

In Canada, the recording stations are all under the direction of the Meteorological Service, and a standard method of obtaining the records is adopted. It is to be noted, however, that the placing of the recording instruments can have a very great influence upon the accuracy of the records. To arrive at the average precipitation upon a district, it is necessary that as many records as possible in the area to be considered should be available, as conclusions based upon records from a limited number of stations are liable to be considerably in error. An ideal condition under which to study rainfall data would be attained if the stations were uniformly distributed over the territory, or placed along each branch of the stream of which the relation between run-off and precipitation was to be established.

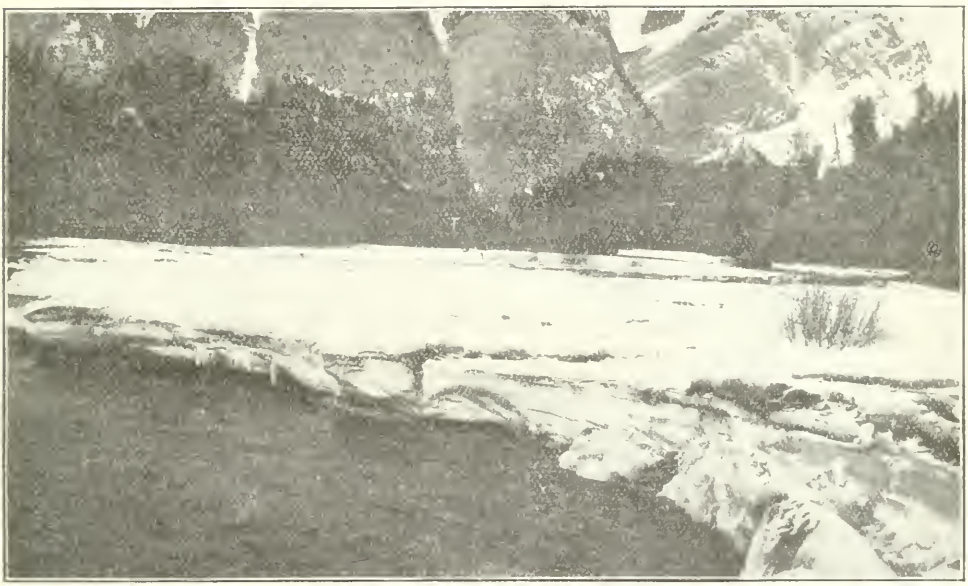


Photo by M. C. Hendry.

Ice Conditions—Cascade River.

Distribution of Precipitation.

A study of the periodical distribution of the rainfall is interesting. Generally this distribution throughout the year, from year to year, is fairly constant in any district, but is different in different districts; for instance, there is a similarity in the distribution in the different localities along the Pacific coast; the same may be said of the territory to the east of the Rockies, while that portion around the Great Lakes has its typical distribution.

Two tables showing the fluctuation in the annual precipitation recorded at Banff and Calgary have been prepared, and appear at the end of the report. At Banff, the records are available at intervals from 1890 to 1896, from which year they are continuous to date; during that period, the maximum precipitation occurred in 1902, 30.59 inches being recorded, and the minimum was 10.33 inches in 1903; the mean yearly precipitation for twenty years is 19.13 inches. At Calgary, the records are available from 1885 to date, during which interval the lowest recorded annual precipitation occurred in 1892, 7.91 inches being the

amount; and in 1902, the maximum precipitation occurrred, 34.57 inches being recorded; the mean yearly precipitation over the period of twenty-seven years is 16.10 inches.

Owing to the scattered location of the recording stations in the district—at Banff, Calgary, and Jumping Pound (from the latter, only partial records are available)—they do not truly represent the conditions obtaining in the basin.

As has been mentioned before, the precipitation increases in this locality with the altitude; the altitude of the station at Calgary is approximately 3,400, that at Jumping Pound about 4,200, and at Banff 4,525 feet, and an examination of the records will show a greater precipitation at Banff and Jumping Pound than at Calgary, that recorded at Banff being the heaviest of the three. The sources of the Bow river and its tributaries are at much greater altitude than is the gauging station at Banff; in fact the greater part of the drainage area above Kananaskis falls lies above this altitude, so that the stations are by no means representative of the greater part of the drainage basin.

Relation of Precipitation to Runoff.

If the records of precipitation are compared with those of the run-off on the basin, it will be found that the recorded run-off exceeds the precipitation as recorded at Banff, by as much as 25 per cent. This condition is by no means uncommon for mountain districts. Mr John R. Freeman, in his report on the Hetch Hetchy Water Supply for San Francisco, says:—

> "In regard to the excess of run-off over precipitation, the fact that depth of run-off exceeded depth of rainfall at outlet simply proves that the average precipitation for the catchment as a whole was far greater than at this comparatively sheltered spot of lower altitude at the outlet of the valley."

This condition holds in the Bow basin, and emphasizes the need of more stations for the recording of precipitation.

On account of the short period over which complete run-off data are available, and the few precipitation recording stations in the catchment area, no definite relation can be established between run-off and precipitation. The only conclusion that can be arrived at from a study of these data is that for the water years from 1909 to 1911, the mean precipitation has been nearly equal to the mean yearly precipitation for the last sixteen years, as recorded at Banff. It is fair, therefore, to assume that the run-off during the same years represent approximately the mean run-off conditions during a like period.

Division of the Year.

In considering the relation of precipitation to run-off, a period known as a "water year" is made use of, instead of the calendar year. This period for the Bow Basin district may be assumed as extending from October 1 until September 30, for practically all of the water is obtained from the mountains, and from October 1 on, the precipitation in the form of snow is stored in the mountains to be held until the warm sun of the following early summer releases it, to form the summer freshets which occur during May, June and July.

TEMPERATURE.

Temperature in the Bow river drainage area is one of the great factors influencing the discharge of the river; in the upper part of the catchment area there is not a month in the year in which frost cannot be expected. The range of temperature is great, the range of mean temperature at Banff (see tables) is

Diagram showing
DAILY DISCHARGE IN SECOND-FEET
OF THE
BOW RIVER
AND
MEAN DAILY TEMPERATURE IN DEGREES FAHRENHEIT
FROM
April 1910, to December 1912 as recorded
AT BANFF, ALTA..

To accompany report on Power and Storage Investigation
by M C Hendry, B.A.Sc.

Commissioner — Chief Engineer
M C Hendry

—LEGEND—

1910 Discharge Curve shewn thus				
1911	do.	do	do	do
1912	do.	do	do	do
1910 Temperature Curve		do	do	do
1911	do	do	do	do
1912	do	do	do	do

Discharge in Second-Feet

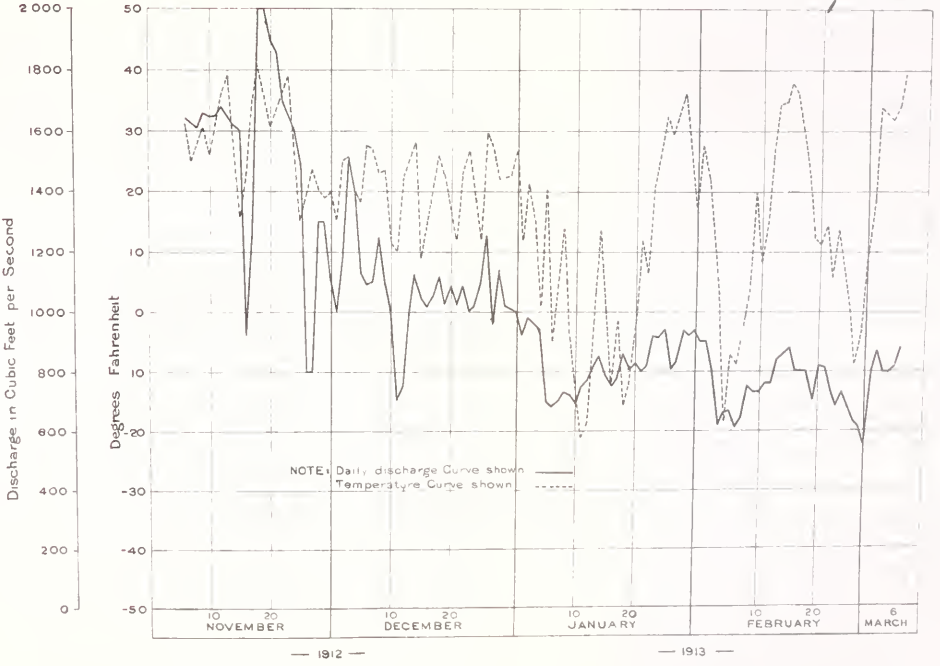
Degrees Fahrenheit

JANUARY FEBRUARY MARCH APRIL MAY JUNE JULY AUGUST SEPTEMBER OCTOBER NOVEMBER DECEMBER

Diagram showing
DAILY DISCHARGE IN SECOND-FEET
OF THE
BOW RIVER
AT
HORSESHOE FALLS
AND
MEAN DAILY TEMPERATURE IN DEGREES FAHRENHEIT
from November 6th 1912, to March 6th 1913
as recorded at
BANFF, ALTA.

To accompany report on Power and Storage Investigation
by M.C. hendry, B.A.Sc.

Consulting Engineer
M. C. Hendry Chief Engineer



from 56°.9 in July to 13°.7 in January, or 43°.2 of difference; at Calgary, the range of mean temperature is from 70°.7 in July to 14°.2 in January, or a range of 66°.4; and the maximum and minimum temperature greatly exceed these. From these two records it will be seen that the one at the higher altitude registered the lowest temperature. At the higher altitudes it is to be expected that low temperatures will be encountered, and that the period during which conditions of low temperature obtain will be longer than at the lower levels. The records are taken at an altitude which is low, considering the drainage area of the Bow river as a whole, and hence do not represent truly conditions in the upper part of the valley of that river; they give, however, an indication of the conditions to be found and, upon study, reveal some interesting facts with regard to the bearing of temperature upon the discharge of the river.

Influence upon Evaporation.

The influence of temperature upon evaporation is one which is constant and unmistakable, but is one for which, so far, no relation has been established. Sufficient data are not available for a study of the question in the district, but in passing it seems well to note the work that has been done in this regard, and which is well summed up in a paper by Mr. Rafter, published by the United States Geological Survey. In this paper Mr. Rafter had made a careful analysis of the available data, and he reached the conclusion that no definite relation exists between evaporation and temperature, but that the influence is a constant one, and cannot be disregarded.

Influence of Temperature on Discharge.

There is no other single condition which plays such a vital part, or has such a direct influence upon the discharge of the rivers of the district as temperature. A diagram, Plate No. 2, has been prepared, showing graphically this relationship—the daily discharges of the Bow river at Banff have been plotted continuously, and on top of this has been plotted the mean daily temperature as recorded at Banff from April, 1910, to December, 1912. Another diagram, Plate No. 3, has been prepared for the period November 6, 1912, to March 6, 1913, showing the mean daily discharge for the Bow river at Horseshoe falls, and the mean daily temperature as recorded at Banff.

A study of these diagrams will reveal how direct is the influence of temperature upon the discharge of the river; during months of low temperature the discharge is shown to be low. On the other hand, high temperature corresponds to large discharge, although within the limits of the record, the highest temperatures occur in the month following the highest discharge; this can be explained by the fact that, except upon the mountains permanently covered, the snow has nearly all been melted during June and the early part of July.

The second diagram, Plate No. 3, shows clearly that the influence of low temperature on the discharge is unmistakable. The period selected is that covering the low-water stage of the river, which corresponds to the period during which extreme low temperatures are encountered throughout the interval covered by the curve. It will be noted that the mean temperature is above freezing on only eighteen days, consequently it affects not only the source of the river but also the actual flow in the river itself.

CHAPTER V.

RUN-OFF.

GENERAL.

All rivers having their source on the eastern slope of the Rocky mountains have a characteristic flow quite different from that of the rivers of Eastern Canada. Generally speaking, in the latter streams the low-water conditions exist during the summer months, normal flow occurring throughout the winter months, and high water during the spring. This condition is reversed in the case of the mountain streams. The low-water stage of the rivers extends over the winter months; the flood stage is reached during the early summer, then gradually subsides, the normal stage being reached in the late summer and early fall.

These conditions are typical of the mountain streams, and the Bow river and its tributaries are no exception to the general rule. For the section above Calgary, a hydrograph has been prepared, showing conditions at Horseshoe falls, and it may be considered as typical of the discharge conditions in regard to annual distribution of flow, at any point in the section. (See plate No. 1).

The division of the year according to the calendar does not correspond with the regulation of the river's flow, and it has been found advantageous therefore to make use of a division of the year corresponding to this annual cycle; this division has been called the "water year."

The water year in the district of which the Bow valley forms a part, extends from October 1 to September 30; it is of course an arbitrary division, but it approximates very closely to the different stages of the rivers, beginning with the low-water period. The river derives the greater part of its water from the mountains; roughly speaking, after the first of October, all precipitation of moisture in the mountains is in the form of snow, and remains in that condition until melted by the warm sun during the following summer.

The fluctuation of flow of the river during the early part of the fall and winter months, say from September 1 until November 1, is dependent almost entirely on the rainfall in the lower part of the drainage basin. (See hydrograph of Bow River, Plate No. 1.) During these months the flow is gradually diminishing, due to the storage of precipitation in the form of snow and ice in the higher altitudes. From December 1 until April 1 may be called the low-water period; the river during this period is dependent almost entirely upon the discharge of ground water, springs, and other underground sources. Extreme low water may be expected to occur during January and February; after the end of February the flow is augmented by the melting of snow in the lower parts of the valleys, and the discharge is increased gradually throughout March and April, and by May 15 the first of the floods generally appear; the discharge during May rapidly increases. In the month of June the rainfall is heavy; this, coupled with the melting snows of the mountains, produces a condition favourable to large run-off, and it is on this account that the mean monthly discharge is generally largest for that month.

The rainfall in July is also large, but the amount of snow in the mountains has been greatly depleted, so that the mean discharge is generally lower than for June; very high water may occur, however, during the month of July; in

fact, two of the highest floods on record in the Bow river have been recorded in that month, but the mean discharge for the month is, as a rule, lower than for June.

In the month of August, normal stage of the river is reached, and this continues through September, completing the "water-year." The rainfall during August is frequently heavy, and no doubt has the effect of increasing the discharge of the river very materially.

Underground Flow.

The underground flow in all streams of which the beds are composed of gravel, detritus and similar loose material, must be considered when estimates of run-off or discharge are being made. The indicated surface flow of the river, where the above conditions exist, is not an evidence of the true discharge. The discrepancy between the true flow and the surface flow may be large, while on the other hand the underflow may form but a small part of the total flow of the river.

The character of the stream bottom is one of the chief influences governing underflow. If the material is composed of gravel, or disintegrated rock, such as is to be found in the mountain streams, and where there is little material of a finer nature to fill the interstices, the percentage of voids will be high and the amount of water passing through will be large, resistance to flow being small. If, on the other hand, the bed is composed of the gravel, etc., mixed with sand, the spaces will be small, the resistance to flow will be increased, and in consequence the amount of underflow will form but a very small proportion of the total flow.

The question of slope of the bed of a stream is also an influencing element. Where the bed of a stream is comparatively flat, the amount of the total flow, existing as underflow, will be large, as penetration to a considerable depth in the underlying material may be expected. Where the slope is steep, this penetration is necessarily shallow, and in consequence the underflow is smaller.

There are a number of streams in the Bow River basin where this feature of underflow is remarked, and perhaps the best example of this is on the Ghost river, though no attempt has been made to arrive at any conclusion as to the volume of underflow in any case.

The Ghost river owes its name to the fact that at certain points in its course the complete flow of the river disappears.

From a point well up in the mountains the valley of the Ghost river is, for the greater part of its length, very heavily covered with gravel. (See reproduction, page 14.) In many places the valley is quite wide, and during low water the stream is split up into a number of small rivulets, each following its own course across these wide flats; where the gravel is deep, the total low flow of the river disappears in the gravel, to reappear farther downstream.

Another example of underflow in the district is found upon the Elbow. On this river it has been noted through the comparison of practically simultaneous gaugings, that there was apparently less water flowing at one point than was recorded at another higher upstream. Such conditions have been noted in other places, but no attempt has been made to arrive at the magnitude of the underflow at any point.

The existence of this underflow means that there is a flow available for power production larger than gaugings would lead one to expect. The placing of a structure in the stream-bed has the effect of intercepting this sub-surface flow and causing it also to pass through the structures. It also has an important bearing upon the consideration of the relative discharge of different tributaries, and so should not be ignored in any scheme of regulation, or in the study of any hydrographs prepared from current meterings.

Low-Water Discharge.

In the winter months the stream flow is low, and during the period December 15 to March 1, the extreme condition is reached. Just how extreme this condition is may be realized by a study of the following figures: The maximum flood discharge recorded at Horseshoe falls during the period 1910-1911 was on July 24, 1911, when a flow of 14,770 c.f.s. was noted; on January 24, the same year, a minimum discharge of 590 c.f.s. was recorded; for the water-year 1910-11, the mean daily discharge for the period January 1 to May 1 was 851 c.f.s.; for the period October 1 to January 1 the mean daily flow was 1,983 c.f.s. During the remainder of the water-year, the flow was high.

In the above year the discharge during the latter part of December was high, the highest daily flow being December 31, when a discharge of 1,904 c.f.s., was noted; on the first of January, an abrupt change took place, the discharge being under 900 c.f.s., so that the periods for which the mean discharge are given are fairly chosen.

Flood Discharge.

The discharge of a river during flood period, is a factor in any study of power development and is of prime importance. As soon as the design of a structure to be placed in a water course is taken up, the question arises as to what volume of water it may be called upon to discharge under flood conditions, and the best method of safely taking care of the flow at such a time.

Mountain streams are noted for the great difference between their normal and their flood discharge; instances are on record where the ratio between maximum and minimum flow is as high as 1 to 40, and 1 to 50. The Bow river belongs to this class of streams; it is on record that the flood discharge at Calgary has been as high as 54,000 c.f.s. (in the flood of 1897), while the low-water discharge is known to be, at times, less than 1,000 c.f.s. at the same point.

In an interesting report, Mr. P. M. Sauder, Chief Hydrographer of the Irrigation Branch, discusses the floods on the Bow river, and estimates the flood discharge in round numbers at 60,000 c.f.s.; he also speaks of several other floods which have occurred; one in the early part of July, 1902, that followed a period of heavy rains, was very destructive, but it is estimated did not reach the discharge of that of 1897.

Several floods which have occurred are mentioned in Mr. Sauder's report, one in 1879 is stated to have been the largest of which there is any record, and another in 1884, evidence of which places it as 1 foot lower than the flood of 1897; all these floods occurred before any systematic record was kept of run-off data relating to the Bow. Since 1908, almost continuous records have been kept of the run-off, with the exception of the winter months of the first few years; in that time, only two floods of any note have occurred, one in July, 1909, when a discharge of 23,000 c.f.s. was recorded, and another in July, 1912, which is supposed to exceed that of 1909, but for which there are no figures available.

In the same report an estimate has been made of the probable flood discharge for different reaches of the river; they are as follows: From Kananaskis falls to Ghost river, 40,000 c.f.s.; from the Ghost river to the mouth of the Jumping Pound creek, 50,000 c.f.s.; between the Jumping Pound and the mouth of the Elbow river, 60,000 c.f.s.; and below the mouth of the Elbow river, 70,000 c.f.s. This discharge, it will be interesting to note, averages about 19 c.f.s. per square mile of drainage area, or a precipitation of seven-tenths of an inch per twenty-four hours.

Winter Conditions.

The factor which governs in any hydro-electric development, is the discharge of the river during the low-water period; in this district the low-water period occurs during the winter months; therefore, investigation of the winter conditions is of prime importance.

In a previous chapter, the question of temperature was dealt with, in its relation to run-off, and it was there shown that a direct relation exists between the two, especially during the winter months. A brief reference to Plates 2 and 3 is again necessary; it will be seen that a low discharge occurs simultaneous with, or immediately after, a low temperature, and that a high discharge occurs approximately at the time of high temperature. In studying Plate 3 it should be borne in mind that some discrepancy is due to the effect of storage on the natural flow of the river, but the close relationship between discharge and temperature is apparent. The inference drawn from this fact is that the decrease in discharge at times of low temperature is due to the effect of the cold weather upon the flow in the immediate section of the river studied, and not upon the source of the river.

The winter flow of the river is also dependent upon other sources which do not show the immediate effect of temperature, the decrease in flow being gradual.

Stream Measurement.

The measurement of the flow of the Bow river, and streams in the vicinity, has been carried on more or less regularly for some years; gaugings were made as early as 1894, but no continuous records were kept until 1908. From 1908 until 1911, the records are only available for what might be termed the open-water season, while during this period the records are sometimes available as late as the end of December of each year, the flow during January, February, March, and in some cases the early part of April, was not recorded; this particular interval, during which the low-water flow occurs, is the vital period from a power standpoint. This work has been carried on by the Hydrographic Survey of the Irrigation Branch.

In the early part of 1911, the work embodied in this report was instituted, and, at the beginning of the same year, the collection of records covering the low-water stage of the river was commenced on the Bow river and three of its tributaries. In order that a complete set of records might be available in the district, an arrangement was made between the Irrigation Branch and the Water Power Branch, whereby additional stations were established at points suggested by Mr. C. H. Mitchell, the expense being borne by the Water Power Branch, and the work of establishing and operating done by the Irrigation Branch; the stations established under this arrangement were; Ghost river, Kananaskis river, Pipestone creek, Bow river at Laggan, and Cascade river.

From a power standpoint, the need of continuous records of run-off in these streams, especially the low-water flow, is very pressing. Almost as often as estimates of the low-water flow are made by parties interested in power development, it is found, when records are subsequently made available, that the flow has been overestimated, frequently as much as 100 per cent. This is no doubt partly due to the rivers being investigated in the summer months, when the flow is high, or above the normal; a condition which is quite the opposite to that found in some other localities at the same period; this, together with the lack of data, is no doubt the cause of errors in estimate.

Discharge Data.

Included as an Appendix are tables giving the daily discharge of the Bow river at different points in its course; also similar tables for the different tributaries above Calgary, and including the Elbow river; these tables are compiled from information placed at the disposal of the Water Power Branch by the Irrigation Branch. In connection with this information, where gaps occur in the records, they are filled out with information obtained from the records of the Calgary Power Company; this refers particularly to the discharge of the Bow river

between the Canadian Pacific Railway bridge and Morley; in this stretch of the river, the records are not continuous at any one point, so that the curves, etc., plotted for one point (generally Horseshoe falls) are a combination of information secured at different points. Up to January, 1912, the Bow was gauged at Morley bridge; between that point and Horse-shoe falls only one stream—Bow Fort creek—enters, and it is of no magnitude. Since January, 1912, the gaugings of the Bow were taken from the Canadian Pacific Railway bridge, about 1½ miles west of the Kananaskis river; between the Canadian Pacific Railway bridge and Horseshoe falls the Kananaskis river enters the Bow; this is a stream of considerable magnitude, but there is a gauging station near its mouth where records have been taken since September, 1911. The Calgary Power Company keeps records of the discharge at their plant at Horseshoe falls.

The curves for the periods are plotted from the data gathered at these several points. It is interesting to note in this connection that comparing the Calgary Power Company's records with those of the Irrigation Branch, the agreement during the period when no water is wasted, is very close for records obtained at Morley bridge, and also the combined records for the stations at the Canadian Pacific Railway bridge and Kananaskis river. During the high-water period, this agreement is not so marked; the discrepancy between the records is no doubt due in a large measure to gauging being made at different stages of the river; this could easily occur during high water, when the discharge varies from hour to hour.

Other tables are also inserted giving the maximum, minimum and mean monthly discharge; also the total monthly discharge in acre-feet, for the different streams in the district, and diagrams showing graphically the discharge of the Bow river at three points, namely, Banff, Horseshoe falls and Calgary, based upon the available data (see diagram, Plate No. 1). Also the Elbow river at Calgary (see diagram, Plate No. 4); and the Spray river at Banff (see diagram Plate No. 5).

ELBOW RIVER

Diagram shewing Mean Monthly Discharge from May 1908 to Dec. 1912

— AT —

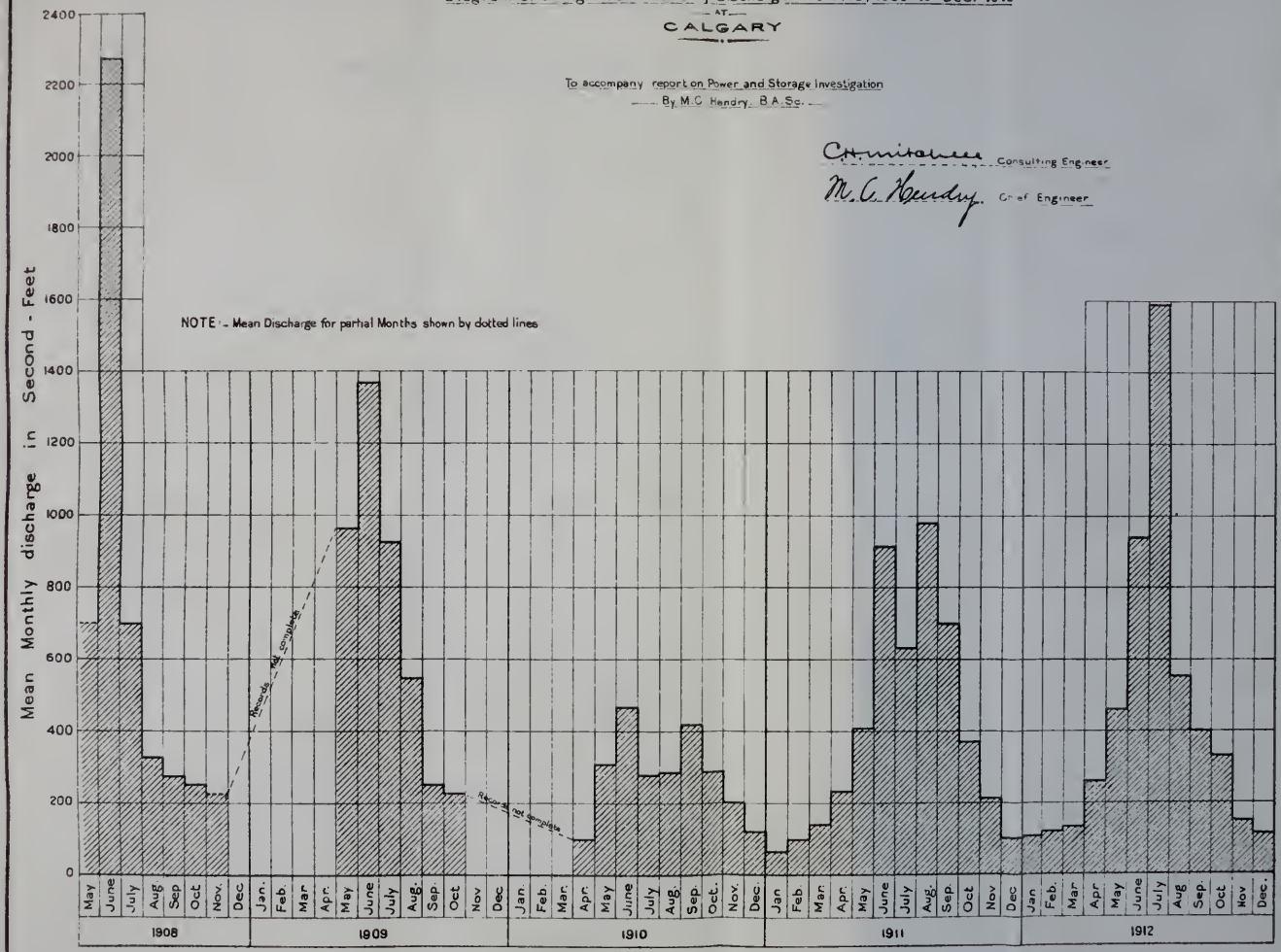
CALGARY

To accompany report on Power and Storage Investigation

— By M.C. Hendry, B.A.Sc. —

C.H. Mitchell Consulting Engineer

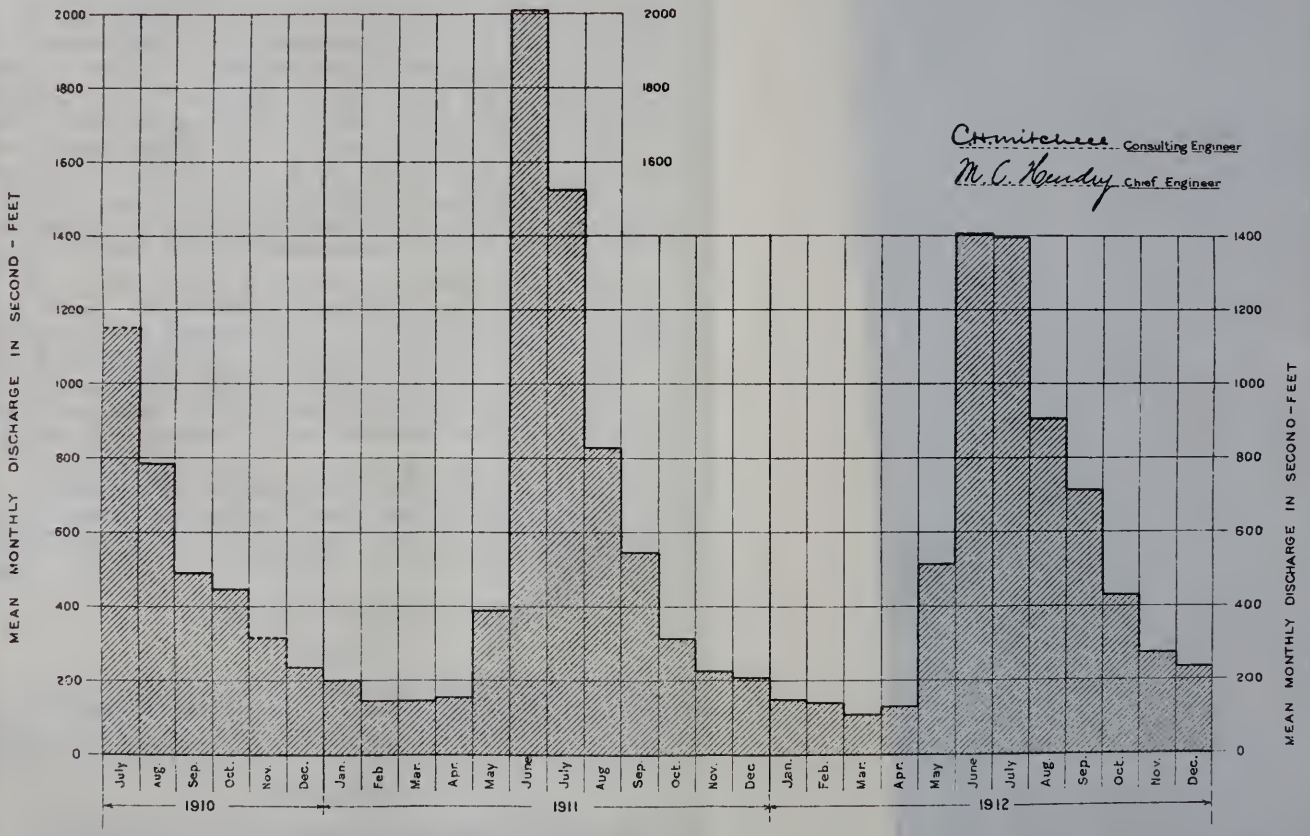
M.C. Hendry Chief Engineer



SPRAY RIVER

Diagram shewing Mean Monthly Discharge from July 1910 to Dec. 1912
AT
BANFF, ALBERTA.

To accompany report on Power and Storage Investigation
By M.C. Hendry, B.A.Sc.



Chas. Mitchell Consulting Engineer
M.C. Hendry Chief Engineer

NOTE:- Meon Discharge for partial Months shown by dotted lines

CHAPTER VI.

EXISTING DEVELOPMENTS.

EAU CLAIRE PLANT.

The first hydro-electric development on the Bow river, in the section from Calgary west, is that of the Eau Claire Lumber Company, situated within the city limits of Calgary. The development makes use of the natural fall in the river, by means of a diverting dam (pile and timber construction) and a canal, and the head developed is in the neighbourhood of 12 feet. The diverting dam is situated just above the bridge crossing the Bow river at Ninth Street West, and the intake and canal are on the south side, the canal following the south bank for about one-half mile. Advantage is taken of small islands or gravel bars, and these, together with timber pile structure, form the stream side of the canal. At the lower end, an island forms the north side of the canal or forebay, the original channel between it and the mainland forming the tail-race. Leffel wheels, set in an open timber wheel case, spanning the channel, are geared to two jack shafts, bolted to two generators. The installation is for 600 horse-power.

The head developed is about 12 feet, the total flow of the river at low water being utilized. The agreement between the company and the old Territorial Government, later approved by Act of Parliament, gives the company the right to the total low flow of the river at that point, and an amount equal to the low flow at high and normal stages of the river.

The development is not on a very permanent basis, and cannot be a very efficient one, though with such a small head, and the restricted flow of the river that exists, the expenditure of not very large sums of money upon its development would be wtarranted.

This plant supplies power for lighting throughout the city of Calgary, having a franchise for the distribution of power. The water-power is assisted by steam generated power, and in consequence the service is liable to very few interruptions, but it is understood that during the winter season the operation of the water-power plant is interrupted for considerable periods, owing to ice troubles.

LAKE LOUISE POWER PLANT.

General.

This plant while very small, and scarcely to be considered from a commercial standpoint, is mentioned for two reasons: first, because it lies within the territory studied; and second, because it is operated in connection with the Canadian Pacific Railway hotel at lake Louise.

Development.

The power station is situated about half a mile from the chalet. The water is conveyed from lake Louise by means of a pipeline about 2,800 feet long to the power station, which is situated on Chalet creek, the outlet of the lake; and which also forms the tail-race.

Intake.

A bridge leading across the outlet of the lake is so designed as to form a dam and overflow for the lake, and also part of intake structure.

Pipeline and Head.

The pipeline which conveys the water to the plant is a wood stave pipe 20 inches in diameter and approximately 2,800 feet long. It is laid on the east side of the creek for the greater part of the distance, and the gross head developed is approximately 140 feet.

Equipment.

The pipeline leads to a 24 inch S. Morgan Smith wheel which runs at 600 r.p.m. The wheel is rated at 100 horse-power, and is belted to a 75 k.w. 3-phase generator which operates at 1,200 r.p.m. and has an exciter mounted on the shaft. The current is transmitted to the chalet at 2,500 volts where it is stepped down to 125 volts for lighting and other uses.

Utilization of Power.

The power output is disposed of at the chalet and also is used for lighting the station and grounds at Laggan. The maximum load is naturally during the tourist season which corresponds to the period of maximum discharge from the lake, so that the power demands are easily met.

The development is interesting from the standpoint of utilization of the flow, which is very limited at all seasons, during the high-water period, and illustrates the value of small hydro-electric plants to the tourist centres.

HORSESHOE FALLS PLANT.

The largest power development on the Bow river, at present completed, is that of the Calgary Power Company. This plant is located at Horseshoe falls, about 50 miles west of Calgary, and here one of the very few concentrated falls to be found upon the Bow, is utilized.

At this point the Bow river in its natural state flows through a deep gorge, the walls and bed of which are formed of a shale banded with sandstone; at the point of development a rock outcropping, which is in the nature of an anticlinal dip, occurs. This has been considerably eroded, and forms a drop in the bed of the river of approximately 25 feet. A solid concrete dam has been built across the gorge upon the lip of this outcrop, and this, with the natural fall, produces a head of 70 feet.

Dam.

The dam (see reproduction page 35) is of solid spillway type, with an inspection and drainage tunnel. In addition to the spillway there are a number of sluice-ways, provided to take care of flood discharges; these are eight in number—four being simply stoplog openings and four being supplied with sluice-gates. The former are 7 feet by 22 feet, the stoplogs being handled by means of hand winches, the other four are controlled by sluice-gates 19 feet by 14 feet of a modified "Stoney Type," operated hydraulically. The spillway section is 140 feet long and, together with the sluices, is sufficient to discharge a flood of 40,000 c.f.s. The inspection tunnel, access to which is gained by means of a well situated midway between the stoplog openings, extends under the spillway section into the rock at the west abutment of the dam.

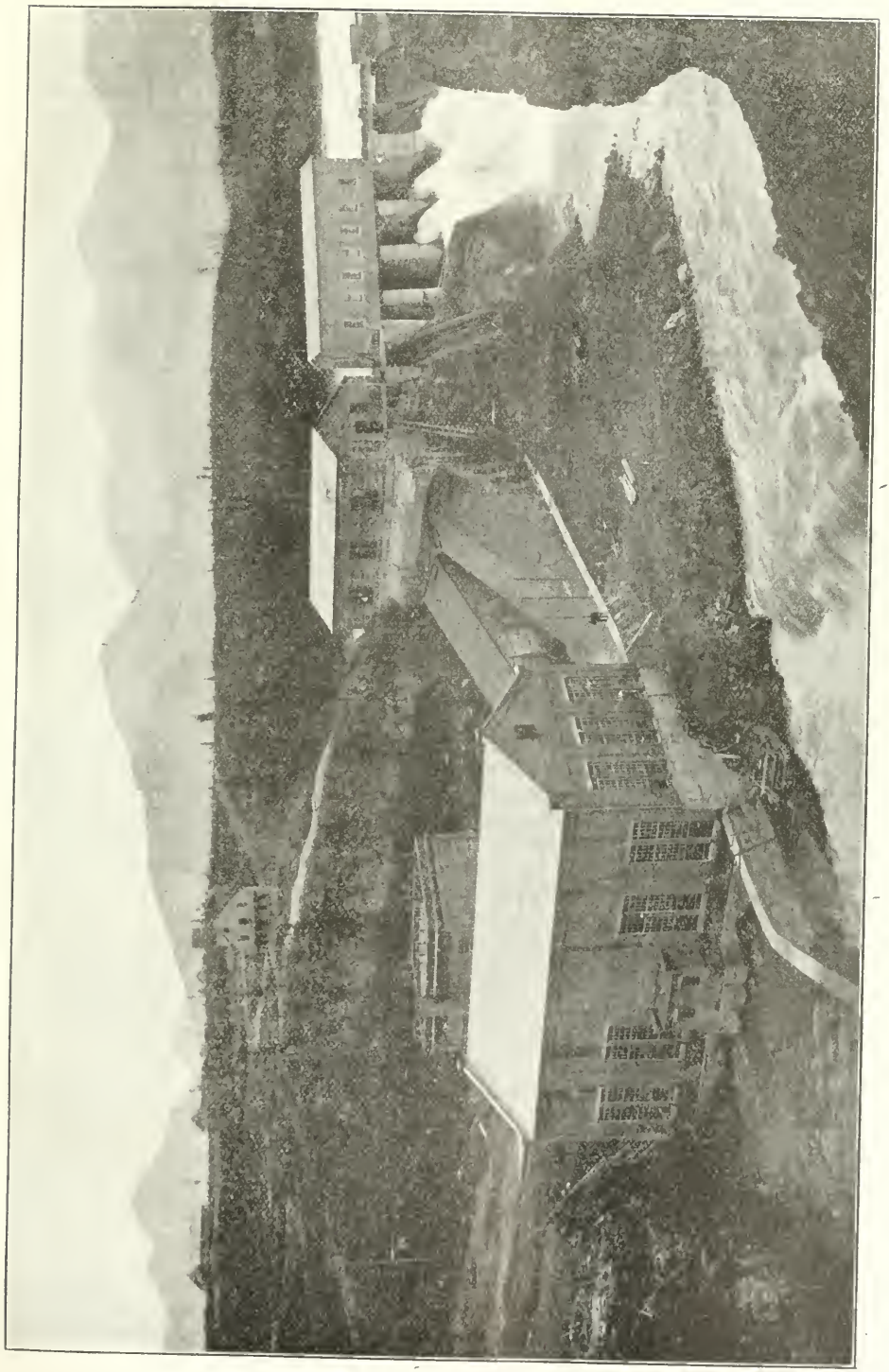


Photo by M. C. Hendry.

Horseshoe Falls Plant.

Intake.

The intake structure is distinct from the dam and occupies a position adjacent to it, approximately parallel to the stream flow. The water, which is admitted through racks and concrete chambers to the penstocks, is controlled by means of stoplogs and butterfly valves placed in the inlet chambers.

Penstocks.

Provision has been made for four penstocks; three of these have been built and one is now under construction. These penstocks are of two sizes; the small ones, 9 feet 6 inches in diameter, and the larger, 12 feet, each delivering water to a single unit. The penstocks are approximately 250 feet in length, supported upon concrete piers, and protected from possible interference from the river at the lower end by a concrete wall. On account of the severity of the climate, it was considered necessary to house the penstocks, and a frame structure was built, inclosing them for their full length.

Power Station.

The power-house (see reproduction page 35), the main part of which measures 118 feet by 56 feet, is situated in the gorge below the dam; it is of steel, concrete and brick construction, and houses the turbines, generators, exciters, etc. At the back of the power house, and partly over the penstocks, the switch and transformer rooms are built. The tail-race is protected from back water in time of flood by means of a wing wall, which separates the tail-race from the river for some distance below the power-house.

Equipment.

The complete turbine installation consists of four turbines of the horizontal double-runner type in steel wheel cases, and two exciter turbines of the single-runner type, the latter being of 330 horse-power capacity each. Two of the main units are of 3,750 horse-power capacity and, with the governors, were supplied by the Jens Orten-Boving Company; they are of Swedish manufacture, as are also those of the exciter sets. The other two main units are of 6,000 horse-power each, built by Wellman Seaver Morgan Company, of Cleveland, Ohio, and are controlled by Lombard governors. The smaller units are directly connected to two generators, of 2,500 k.v.a. capacity, being 3 phase, 60 cycles, 300 r.p.m. machines and operating at 12,000 volts. The other two units, one of which is now installed, are direct-connected to generators of 4,000 k.v.a. capacity, operated at 12,000 volts, 3 phase and 60 cycles. The generators of the exciter sets are 175 k.w., 125 volt, and 700 r.p.m. machines. The generators were built and supplied by the Canadian General Electric.

The current is carried from the machines to two busses, one supplying the lines to Exshaw at 12,000 volts, the other supplying the step-up transformer which raises the voltage to 55,000 for the Calgary lines.

The transformer room contains two 3,000 k.v.a. 12,000 to 55,000 volt, oil-insulated, water-cooled, 3-phase transformers, and two more of the same capacity will be installed very shortly.

Transmission Lines and Substations.

The company has three transmission lines in operation, one extending to Exshaw, a distance of 8 miles, and the others forming a duplicate line to Calgary.

The Exshaw line supplies power to the cement plant at that place; it is a double circuit, 3 phase, 12,000 volt line, strung on wooden poles, the conductors being of six 00 aluminum stranded cable; in connection with the line there is a telephone line strung upon the same poles, and also a ground wire. The transformer station at Exshaw contains four 700 k.v.a. 12,000-600 volt, oil-insulated, water-cooled transformers, with lightning arrestors and switching apparatus complete. The switch apparatus in this station was installed by the Canadian General Electric Company, and the transformers by the General Electric Company of Sweden.

The transmission line to Calgary is in duplicate; each is a single circuit 3 phase 55,000 volt line, the conductors being No. 0 aluminum, with telephone line and ground wire carried on 40 foot wooden poles. The lines are parallel to one another for the first 10½ miles from the power-house, and follow the Canadian Pacific railway; they then separate, line No. 1 turns southwest and leaves the Indian reserve, just to the east of the old south road to Morley, and joins the road outside the reserve; from that point it follows the road allowance to the city of Calgary, following the Springbank road to within 8 miles of the city; the total distance is nearly 51 miles from the power-house to the substation in Calgary. The second line from the point where line No. 1 turns southeast, runs straight to the northeast corner of township 25, range 6, west of the 5th meridian; it follows the north boundary of township 25, ranges 5, 4, 3, and 2 to the northeast corner of section 35 in township 25, range 2, except for a slight jog near Cochrane, where a diversion is made to avoid a line crossing; at the point mentioned it turns south and joins the other line at the southeast corner of section 1 township 24, range 2, and from there to the substation it parallels the other line. This line crosses the Bow at two points; first, just west of Cochrane, and the second time at Shaganappi.

These lines will handle the power output of both the plant at Horseshoe falls and that at Kananaskis falls now being built.

The Calgary substation, the capacity of which is shortly to be increased, provides for delivering power to the city and the Canada Cement Company, at three voltages, 12,000, 2,400 and 600 volts. This is accomplished by means of 3,000 k.v.a., and 1250 k.v.a., oil-insulated, water-cooled, 3 phase transformers with the necessary switch apparatus.

The transformers and switch apparatus were manufactured and installed by the Canadian Westinghouse Company.

Construction.

The design and construction of the plant was carried out by the engineering firm of Smith, Kerry & Chace. The dam presented some interesting problems which required considerable thought and care in solving.

In order that the site of the foundation might be unwatered, and the discharge provided for during construction, two unwatering tunnels were driven on the intake side of the river, from the under side of the lip of the falls up to the upper level, and at such an elevation that only a low coffer-dam was necessary to keep the water out of the foundation of the dam. The rock outcrop which forms the fall, and upon which the dam was constructed, dips across the river at a considerable angle, (see reproduction page 35) and upon unwatering and exploration of the lower part (the section near the north bank) it was found that the material which is illustrated in the section shown on the plan of the development was not of a satisfactory nature for foundation purposes; an examination proved that no better material underlay it, and this material necessitated special treatment. While the section containing the sluice-ways was being built, Mr. John R. Freeman was called in by the company to advise in the matter; his report of October 10, 1910, accompanied by plans showing

layout and proposed changes, was acted upon, and the plans of the plant as built, included here, embody the recommendations made.

Precaution in Construction.

The following precautions were taken, based upon the aforementioned report:

1. The hard sandstone ledge, upon which the dam was to have been built, dipped at such a considerable angle that the cost of carrying the foundations down to this rock throughout the length of the dam, would have been excessive. The northern part of the dam was therefore built upon the shaly rock, overlying the hard sandstone, which it was considered would afford a safe foundation.

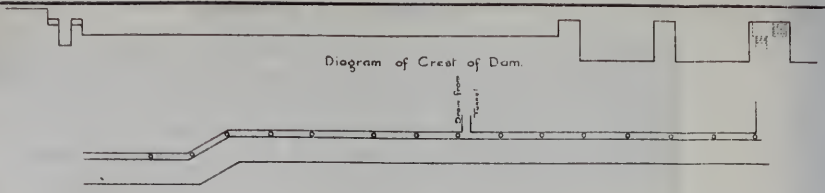
In order to obviate any leakage that might develop through the underlying seams, 3-inch holes were drilled through the rock, about 2 feet in front of the face of the dam, 10 feet apart, and to a depth of about 40 feet; a casing was then placed in the upper part of the hole, and a thin cement grout forced into the holes under a pressure varying between 60 and 80 pounds per square inch until they refused to hold any more. By this means the grout would be forced into any seams in the rock, cross cut by the holes, and for a considerable distance from the holes, by first filling alternate holes and later filling the remainder, it was expected that all the seams would be completely filled for some distance from the line of holes. That considerable grout was absorbed by the seams is shown by the diagram, which shows the amount of cement grout placed in each hole, and the amount necessary to fill the hole itself. (See diagram, Plate No. 6.)

2. The possibility of leakage around the north end of the dam was met by excavating a considerable distance into the cliff, for the total height of the dam; the cliff consists of a soft shale, liable to disintegration on exposure to air, but as the excavations were completely filled with concrete, any water leaking through the seams in the shale would be forced to travel a considerable distance, and the quantity would be greatly reduced by friction, and as the seams are liable to silting, the leakage would be very nearly eliminated.

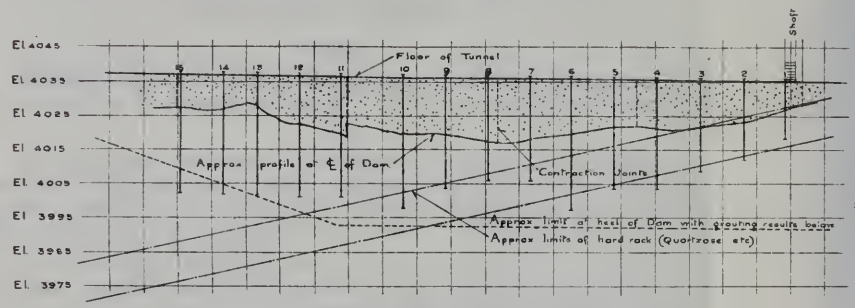
3. The inspection tunnel, before mentioned, also serves the purpose of a drainage tunnel. Drainage holes, about 16 inches square, and placed 16 feet 8 inches apart, extend from the springing line of the arch of the tunnel upward through the body of the dam, so that any leaks that may develop through cracks will be intercepted and directed into the drainage tunnel. Other holes, 3 inches in diameter, and about 12 feet 6 inches apart, have been drilled down through the base of the dam into the underlying rock for depths of from 10 feet to 18 feet; these are cased at their upper end, in order that the quantity of any water leaking through them and also the upward pressure may be measured.

4. The tunnel has been extended into the rock forming the north abutment of the dam for a distance of some 30 feet, so that most of the leakage around the end, if there is any, will be intercepted by the tunnel; this expectation has been realized by the stopping of leakage going on before the tunnel was extended; the tunnel itself is drained through an opening in the downstream side of the dam.

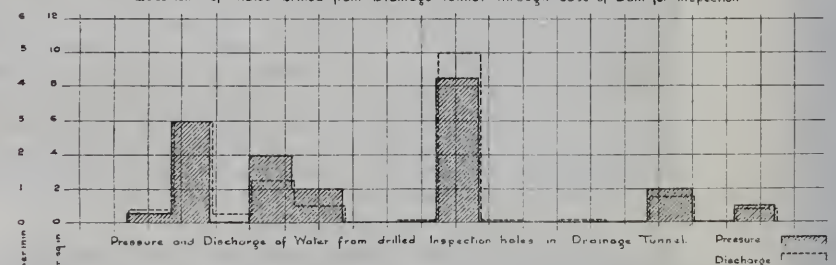
5. The protection of the foundation of the dam at the downstream side has required careful consideration. In order that erosion due to the water coming over the spillway section might be eliminated, Mr. Freeman recommended that the apron of the dam be extended downstream about 40 feet, heavily reinforced and anchored to the rock, and that baffle piers be built on the apron to reduce the velocity of the water and thereby prevent any possible erosion. Other recommendations were made, one was the building of a baffle wall on the crest of the old falls at the south end of the dam, and the facing of the cliff below to prevent undermining, but these recommendations, together with that of placing of a sand blanket over the bed of the river, have not yet been carried out.



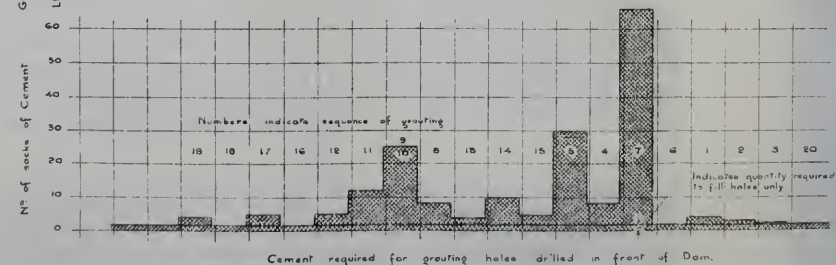
Plan of Drainage Tunnel showing positions of drilled holes for Inspection



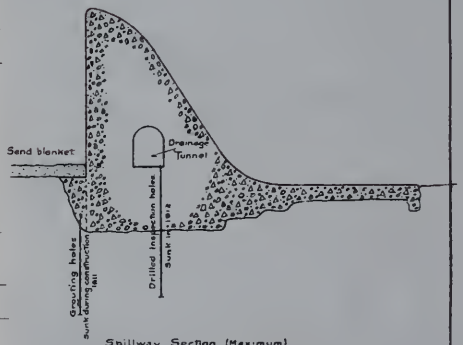
Location of holes drilled from Drainage Tunnel through base of Dam for Inspection



Pressure and Discharge of Water from drilled Inspection holes in Drainage Tunnel.


No of sacks of Cement
Numbers indicate sequence of grouting
18 16 17 16 12 11 9 10 8 13 14 15 5 4 7 6 1 2 3 20
Indicates quantity required to fill holes only

Cement required for grouting holes drilled in front of Dam.



Spillway Section (Maximum)
showing relation of grouted holes to drilled inspection holes

BOW RIVER
AT HORSESHOE FALLS

Diagram showing grouting & inspection holes beneath Calgary Power Co's Dam.

Compiled by C.H.Mitchell
To accompany report on Horseshoe Falls Plant

To accompany report on Power and Storage Investigation by M.C. Hendry, B.A.Sc.

Consulting Engineer

M.C. Hendry Chief Engineer

JANUARY 1913

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Inspection and Approval.

In a foregoing part of this report, the policy of the Water Power Branch in regard to the approval and inspection of any water-power development has been set out. This policy in the case of Horseshoe falls, has, with the exception of the appointment of a resident engineer, been carried out; Mr. John R. Freeman was consulted by the company with regard to the plans, and Mr. C. H. Mitchell, C.E., as consulting engineer on the Bow river work, made several inspections of the plant both during the latter part of construction, and after completion, and has submitted two reports to the branch covering the work.

KANANASKIS FALLS PLANT.

General.

The Kananaskis Falls plant is placed under the heading of plants in existence, though at the present writing it is only in the course of construction.

Site.

The site of the Kananaskis Falls plant is at the falls of that name on the Bow river. These are about 2 miles upstream from the Horseshoe Falls plant, and immediately below the junction of the Bow and Kananaskis rivers: in fact the latter stream, entering from the south, adds its waters within the limit of the rapids at the head of the falls.

The total fall at this point occurs in four sections; first, the rapids just mentioned, and then a series of three falls, giving a total drop of approximately 55 feet. Above the rapids the Bow river is wide and fairly shallow (see reproduction page 40), the banks are comparatively low, gradually increasing in height to the head of the falls. Below the falls, the banks are perpendicular, the river flowing through a rather wide canyon. The banks of the Kananaskis are high; the west bank is perpendicular, rising at least 40 feet above the surface of the stream; the slope of the east bank is more gradual for the first few hundred yards, but after that it is high and abrupt.

The Canadian Pacific railway crosses the Kananaskis river by a bridge that spans the stream about 250 yards above its mouth, and the Bow river by another bridge about 1 mile above the falls. The existence of these bridges has a very direct bearing upon the question of development at this point.

Development.

The general scheme of development adopted is that of a dam, placed across the head of the falls, by means of which the water is raised and diverted into a canal excavated on the south side of the river. The water will be conveyed by the canal to an intake structure situated on the south bank and provided with suitable racks and gates for controlling the flow. From the intake the water will be conveyed in pressure tunnels, to the wheels placed in concrete scroll chambers situated below the power station, and thence in draft tubes to discharge tunnels leading to the river below the falls. The working head for which the plant is designed is 70 feet (see plans.)

Dam.

The dam at the head of the falls will raise the water to an elevation of 4,155 feet sea level datum; this elevation was finally determined owing to the existence of the Canadian Pacific Railway bridge across the Kananaskis river, about 250 yards from the mouth. The bridge is of the inverted truss type, and the elevation of the lower chord was the controlling feature. Permission was secured from the Canadian Pacific Railway to raise the tracks at this

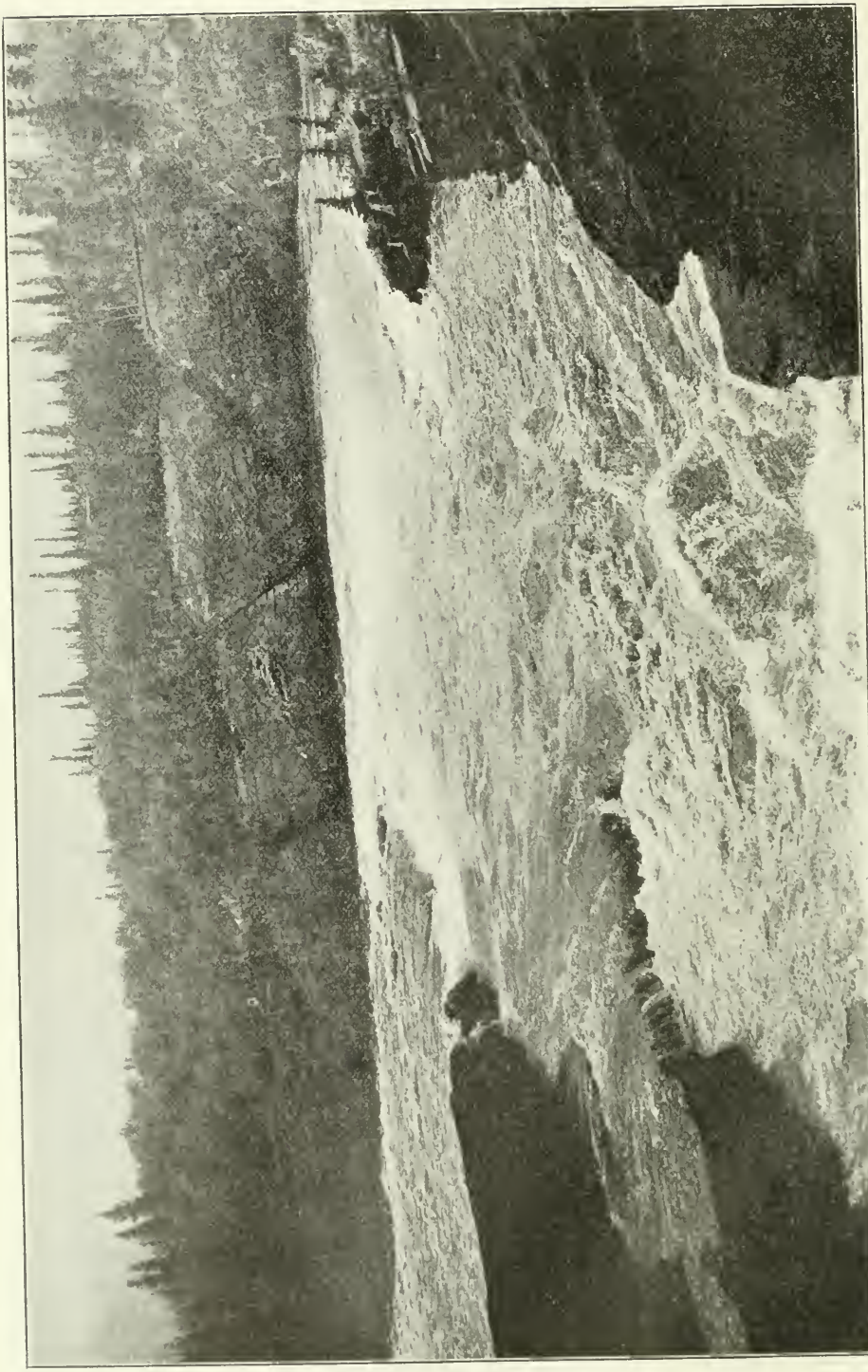


Photo by M. C. Hendry.

Kananaskis Falls. Looking upstream.

point 3 feet. The new elevation of the bottom chord became 4,161.75. The top elevation for flash-boards and stoplogs authorized by the department has been fixed at 4,155.75, or 6 feet below the bottom chord of the Canadian Pacific Railway bridge over the Kananaskis. The dam is being built upon a ledge of rock extending practically across the river (see plan), and is in three sections.

The first section, which is about 200 feet long, is nearly parallel to the centre line of the canal; the shore end of this section is in the nature of a retaining wall, while the outer 180 feet, or that portion nearest the angle, is of the spillway section, made up of nine 17 foot openings with 3 foot piers between.

The central section is 174 feet long, and is provided with eight 17-foot openings, with 3-foot piers between and one 24-foot opening in the nature of a spillway. The section is built partially upon, and partially below, the ridge of rock mentioned (see plans), and is provided with two inspection tunnels, one above and one below the ridge; drains are placed at frequent intervals leading from the face of the rock to the inspection tunnel. In addition, a line of holes is being drilled along the face of the dam down through the rock, and grouted, the idea being to close any seams that may underlie the dam. (See reproductions pages 144 and 148).

The third section, forming the connecting link between the central section and the north bank of the river, runs upstream, making an angle of about 30° with the centre portion. It is 268 feet in length between abutments, and is provided with eleven 18-foot openings, with intermediate piers 7 feet thick. It is proposed to control these 18-foot openings with stoplogs operated from a deck running the length of the dam, the bottom of the deck being at elevation 4,162. The elevation of sills of these openings has been finally determined as 4,138. Working level being 4,155, which may be raised to 4,155.75 by flash-boards. This section is also provided with an inspection tunnel extending to the north bank, and having an extension in the form of a drift leading into the rock forming the north abutment; by means of this drift it is expected to cut off possible leakage around the end of the dam and minimize danger to the structure in that respect. In addition, holes were drilled in front of this wall and then grouted under pressure. Access to the inspection tunnels is had by means of a shaft in the block, forming the junction between the second and third sections; this shaft leads to the tunnels, and also has an opening to the lower side of the dam; there is also a shaft in the north abutment of the dam, leading to the tunnels.

Discharging Capacity.

The discharging capacity of the structure under certain conditions is given below in tabular form. It should be noted that, with the exception of the roll-way and log run, the discharge is dependent upon manual operation, and is not automatic except above elevation 4,155.

Discharging Capacity of Kananaskis Dam.—Table No. 9.

Elevation of Head-water.	Discharge through eleven 18-ft. sluices in sec.-ft. Elev. of sill 4138.	Discharge through rollway and log run in sec.-ft. (automatic.)	Discharge through sluice-ways and with stoplogs at elev. 4155 (automatic) sec.-ft.	Total Discharge sec.-ft.
4152·0	34,600	0	0	34,600
4153·0	38,400	0	0	38,400
4154·0	42,400	0	0	42,400
4155·0	46,100	0	0	46,100
4156·0	50,300	940	660	51,240
4157·0	54,400	2,820	1,750	57,220
4158·0	58,800	5,450	3,425	64,250

Canal and Forebay.

The canal is excavated in rock, sand and clay. The formation through which it is excavated is rather peculiar, owing to the great tilting of the rock, which is to be found in all parts of the district, the rock surface appears as a series of saw teeth, the intervening spaces being filled with clay, sand and gravel; through the rock section the canal is 72 feet wide, and in the earth 40 feet wide on the bottom, and 80 feet wide on top, the bottom elevation being at 4,140; it is approximately 650 feet long.

The forebay to which the canal leads is divided into two bays, one for each pressure tube, and these are in turn divided into two openings by central piers; these openings are controlled by means of "Tainter Gates" though stoplogs, working in gains may be placed in the entrance piers. Each bay is 34 feet wide, and each opening 14 feet, the dividing pier being 6 feet wide. The method of operating is not definitely settled, but will be mechanical.

Pressure Tubes.

Easy entrance by wide passages is had from the forebay to the pressure tunnels, which are of reinforced concrete and lead to the wheels situated in wheel pits below the power house.

Power Station and Equipment.

The power station is built in excavation near the river bank. The necessity of placing the station in excavation was determined by the economical length of solid steel shafting connecting the generators and turbines.

The substructure is of concrete and the superstructure of steel and hollow tile construction.

In addition to the electrical and hydraulic equipment described below, the station is provided with a 50-ton crane, pumps, etc.

The electrical equipment will consist of two vertical shaft type, direct-connected 3,750 k.v.a., 12,000 volts, 3 phase, 60 cycle generators, together with necessary exciters and motor generator set, switch apparatus, etc.; 12,000 volt. busses will be direct connected to the Exshaw line, no step-up transformers being used. With this arrangement, power may be delivered either to Exshaw or Calgary through the Horseshoe Falls plant, the two plants being connected.

The turbines are vertical shaft type, each of 5,800 h.p. capacity with scroll cases formed in the concrete, giving easy entrance to the wheels. The method of installing these wheels is similar in many respects to that used at the large plant at Keokuk on the Mississippi.

Market.

The market supplied with power from the Calgary Power Company's plants is within 50 miles of the stations, and the demand is concentrated at two points—Calgary and Exshaw. At Exshaw the load is that derived from the cement plant, which takes all the power delivered at this point; at Calgary the load is that derived from the Canada Cement Company's plant, and the city of Calgary. The latter buys power from the power company and distributes it by means of its own system.

The demand for power has been increasing rapidly; the company first installed two 3,500 k.v.a. machines; this was at once increased by the addition of a 4,000 k.v.a. machine, and the latter is being duplicated, so that the equipment will provide for a generating capacity of approximately 18,000 h.p.

In addition to the foregoing, the company has at present under construction the plant at Kananaskis falls, which when completed will have a capacity of 10,000 h.p.

The city of Calgary has recently had an investigation made of the power situation in its various phases, and the results of this work, which was carried out by Mr. R. A. Ross, C.E., of Montreal; are contained in a report by him. He estimated the amount of power that would be required in the near future, *i.e.*, by the fall of 1913, at 12,000 k.w., and also that in ten years an output of 40,000 to 45,000 k.w. will be required, assuming that the population will then be 200,000.

These figures seem large, but it is pointed out in the report:—(1) "That you anticipate bonusing industries by means of cheap power. . . . . "; (2) that " owing to cheap rates, electric light will be universally used"; and (3) that "your output will be more readily absorbed by new industries, which are not committed to any particular method of power development as in older municipalities. . . . all of which will tend to make your demands much higher than for a similar sized municipality in the East."

RATES AS CHARGED BY CITY OF CALGARY FOR POWER—TABLE NO. 10.

Motor Rating.	Charge per horse-power per year.
	$
1– 3 horse-power.	41 89
4– 9 "	37.71
10–18 "	33 52
19–54 "	27.23
55 horse-power and over.	23 04

The cost for lighting is 7½ cents per k.w. hour.

1912-13 peak loads:—

Municipal system, the peak load in December, 1912, was.....

.....9,300 horse-power

Eau Claire plant, the peak load for the same month was.....

.....2,345 horse-power

GROWTH OF POWER LOAD DEMANDS INVESTIGATION.

The phenomenal growth of the country at large is of necessity reflected in the growth in the demand for power, both for industrial uses and for lighting. This rapid increase in demand is illustrated in the history of the municipal plant at Calgary, which, starting with a capacity of 260 k.w. in November, 1905, has grown by leaps and bounds, practically doubling yearly, until at present approximately 6,000 k.w. is installed in the station.

The history of the Calgary Power Company, which started to operate in May, 1911, with two 2,500 k.v.a. machines is similar; the first two units were scarcely running when the installation of a third unit was commenced, and at present the fourth is being installed in their Horseshoe Falls plant. Even with this increase, they are unable to keep up with the demand for power, and work is now in progress upon a second plant at Kananaskis Falls, which when completed will generate in the neighbourhood of 10,000 horse-power. These two plants combined will give a generator capacity of about 28,000 horse-power.

It is reasonable to expect, therefore, that within a very short time the present sources of power will be loaded to capacity, and development at other points will become necessary if power is to be supplied by hydro-electric plants.

Intimately connected with the question of increase in the demand for

power is the question of increasing the output at the present developments, a question which is demanding the most careful consideration on the part of the companies developing, and intending to develop, power upon the Bow river, and it is therefore very fortunate that the problem has been attacked in the comprehensive manner adopted by the Water Power Branch.

The question of increasing output is that of increased flow of the river during the low-water period. As has been pointed out in an earlier part of this report, the flow during the winter months is of a very small volume, and unless some system of regulation is developed, the power output, depending as it does upon the flow as influenced by the variation in temperature, will vary very considerably from day to day. For instance, during the month of February, 1911, (which may be considered the low-water month), the mean discharge was 745 c.f.s.; the lowest for the month occurred on the 23rd and was 600 c.f.s. This is not the lowest on record, as a discharge of 550 c.f.s. has been noted at the plant at Horseshoe falls. The maximum continuous output of the plant, then, during 1911, must be based upon this flow, giving 3,818 horse-power on the shaft of the turbine at 80 per cent efficiency.

For purposes of comparison, suppose that the plant at Kananaskis was in condition to deliver power, then the water could be used twice, or with the 70-foot head to be developed at that point, a total output of the two plants of 7,636 horse-power on the shaft could be obtained.

A "HORSE-POWER . . . . . PERCENTAGE OF TIME" curve has been plotted for these two plants (see diagram, Plate No. 20); this curve will be described more fully later, but at this point it is interesting to note for what period, in percentage of time, it is possible to operate to the full capacity of the plants. From the above it will be seen that the question of regulation of the flow of the river is vital from a power standpoint. During the period of flood, the capacity of the openings in the structures is taxed to the utmost to safely pass the flow of the river, and then succeeds a period when every cubic foot of water must be conserved in order that the plants may be operated, even at a fraction of their normal output; the investigation into the possiblities of storage upon the Bow river and its tributaries as set forth in this report was undertaken to try to solve the problem of regulation.

CHAPTER VII.

POSSIBLE DEVELOPMENTS.

General.

The possibility of further development of power upon the Bow river and its tributaries is, owing to their topography, confined in a general way to particular stretches of the rivers. Upon the Elbow river the power-producing part of the river is high up in the foot-hills, where it is confined to a narrow channel by high banks, breaking through at times into wide flats which, being confined at the lower end, afford possible power and storage sites. On the Bow river itself, the power-producing portion of the river, as has been pointed out, may be described as that part lying between Kananaskis falls and Calgary. The lower part of this stretch does not offer any particular site, and only one attempt has been made at development, namely, the Eau Claire plant at Calgary, that has been already described.

Methods of Investigation.

The whole power-producing section has been investigated in a general way, while particular attention was given to the part between Kananaskis falls and Radnor, of which a complete contour survey was made. Studies were made of a number of points on the ground, and a more detailed survey made of those considered worthy of particular attention in the field. After study in the office of the detail plans of these points, it has been found that there are a number worthy of consideration as feasible developments.

The same method was adopted on the Elbow river; there the stretch of the river was studied carefully and after the consideration of several alternative schemes, a single development, covering nearly the whole of the power section of the river, was decided upon, and surveys were made. A storage scheme was also worked out in connection with this development.

In order that these different schemes might be studied, and their feasibility arrived at, layouts have been worked up for the different developments with some degree of detail, and estimates based upon these have been made.

It is pointed out that these layouts are for study only, and should not be considered as final designs.

The sites on the Bow river to which special attention has been given are known as:—

1. Kananaskis Falls (being built).
2. Bow Fort.
3. Mission.
4. Ghost.
5. Radnor.

On the Elbow river:—
Elbow river site near Canyon creek.

On Cascade river:—
Minnewanka Dam.

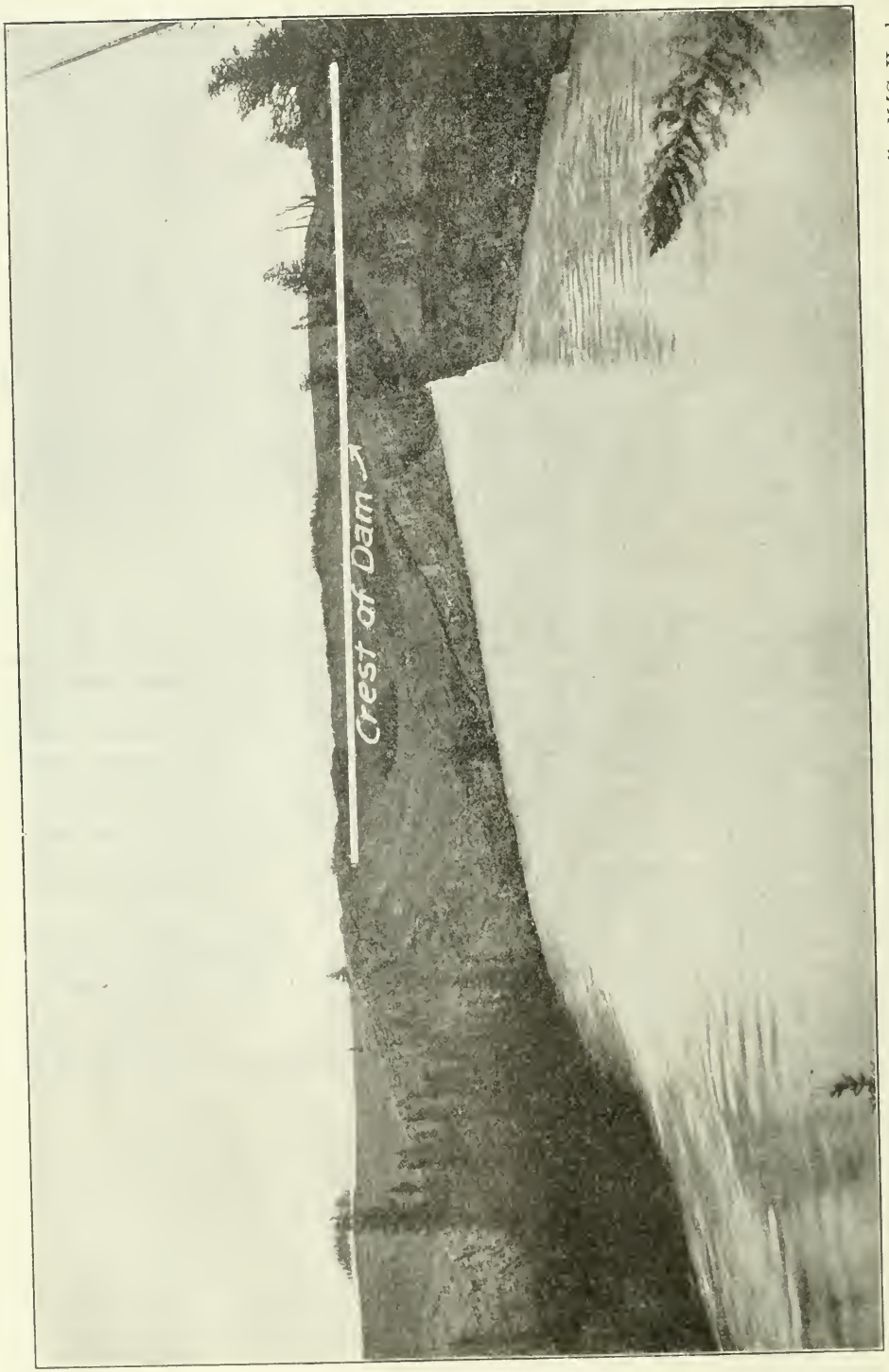


Photo by M. C. Hendry.

Bow Fort Site from Upstream

SESSIONAL PAPER No. 25e

BOW FORT SITE.

General.

The Bow river, after passing the Calgary Power Company's plant at Horseshoe falls, flows between high banks for about 3 miles, and at very few points in this distance is it possible to get down to water level, the banks for the most part being precipitous and rising to heights of from 40 to 150, and even 200 feet in places. At several places the stream is very much confined (see topographical sheets No. 4 and No. 4A and reproduction page 41), flowing through narrow gaps in the rock outcrops. A point in regard to the geology of the river is of interest here: Below the Horseshoe falls, the general dip of the rock changes twice in a distance of 3 miles; at the Calgary Power Company's plant the dip is towards the west (see reproduction page 35), about a mile below the dip is east, while below the mouth of Bow Fort creek it has changed to the west again. About a half a mile below the mouth of Bow Fort creek the character of the banks undergoes a change, and for a number of miles below this point high steep banks alternate with wide flats.

A number of rapids and swifts occur between the falls and the point just mentioned, the principal ones being about half a mile, and a mile and a half below the falls, and one about three-quarters of a mile above the mouth of Bow Fort creek. The total fall between the tail-race of the Calgary Power Company's plant and the point below Bow Fort creek where the change in the banks takes place, is approximately 70 feet.

Between the mouth of the creek and the end of the section just described the banks are high and almost perpendicular, especially immediately above the lower end; just below the section there is a wide flat which lies on the south side of the river at an elevation of a few feet above the level of the river, and it is at this point, known as Bow Fort site that a detail study has been made.

Site.

Bow Fort site lies at the extreme lower end of the section just described, about half a mile below the mouth of Bow Fort creek and three and three-quarter miles below the plant at Horseshoe falls.

Just above the flat mentioned, the river flows between perpendicular rock cliffs between 40 and 50 feet high, and from the edge of the cliffs the banks rise rather steeply, with a slope of 40 or 50 feet in two or three hundred, to the foot of the main valley banks on the south side; on the north side the slope is much steeper; these slopes are of solid rock, thinly overlaid with soil. From edge to edge of the cliffs the distance is only 265 feet, the general tilt of the rock is towards the west and the general characteristics of the site give the impression that there was a fall in the river here at one time, the cliff having been cut back until all that remains is a slight drop, which entirely disappears at high water. The cause of this drop is a ledge of rock extending across the river; and it is upon this ledge that it is proposed to place the dam, the intake being in the south bank and penstocks leading to the power station situated on the flat below.

Water Supply.

Under the present conditions of the river, that is without storage, the low-water discharge between Kananaskis falls and the mouth of the Ghost may be expected to go as low as 600 second-feet, though only for short periods (see discharge curves). With the storage contemplated on the upper part of the river, it is expected that a minimum flow of 1,500 second-feet will be obtained, and it is upon this basis of discharge that the schemes above the mouth of the

Ghost are worked out; the intake structures and hydraulic equipment are designed for a flow of 2,000 second-feet, such a flow being available for a great part of the year; the extra equipment would also act as a spare unit, or stand-by. The flood that the structures are expected to discharge safely is one of 50,000 second-feet. These, therefore, are the conditions of flow for which the plant has been designed:—

A minimum flow of 1,500 c.f.s., with extra equipment for a discharge of 2,000 c.f.s. to also act as a stand-by.

A maximum discharge of 50,000 c.f.s.

Development.

Several schemes of developing the power available at this point have been studied, the one here presented being finally settled upon as the most feasible. In order that these studies may be more comprehensive, designs have been prepared and are included in the report, but these are for the purpose mentioned, and are not intended as final.

The proposed scheme places a dam across the river at the point in question; here the gorge is 265 feet wide, the walls are nearly perpendicular, and the river fills the whole of the bottom of the canyon.

On the north side of the dam line the cliff rises 25 feet from the water surface, then slopes back for a distance of 50 feet, rising another 20 feet to the foot of a rock cliff some 30 feet high, the intermediate slope being formed of gravel and disintegrated rock from the cliff above. It is proposed to remove this material and place four sluice-ways at the end of the dam, using the cliff for the north abutment of the structure.

On the south side the cliff is higher, rising sheer 40 feet from the water's edge. From the top of the cliff the slope is steep, rising 25 feet in 100; this slope is formed by the dip of the rock, which at this point is overlaid with soil to a depth of only a few inches.

Head.

By placing the dam at this point a total head of 66 feet may be developed, part of which is the natural fall in the river above the site, the extra two or three feet being obtained below. To obtain this head, the water above the dam would be backed up nearly to the tail-water of the Horseshoe Falls plant and about 2 feet would intervene between the head and tail-waters of the two plants.

Dam.

The dam proposed is of the hollow reinforced concrete type, founded upon ledge rock existing in the river-bed; it would be 265 feet long between the cliffs of the river, and 350 feet long over all, including the sluice-ways; the total height of the structure would be 75 feet, from foundation to spillway crest.

The dam would be provided with four openings 20 feet by 24 feet at the north end, and controlled by stoney sluice-gates provided with proper operating mechanism and housed; these could be used for additional discharge during floods. In addition, there would be two stoplog openings, 16 feet long, and three 72 inch valves controlling additional sluice-ways in the base of the dam. These openings, together with 200 feet of spillway section, will provide for a flood discharge of 50,000 second-feet.

It may be mentioned here that, from Canadian Pacific Railway Company's data relating to the high water in the Bow river, the engineers of the Calgary Power Company have computed that the maximum flood discharge at Horseshoe falls, which occurred in June, 1902, was 43,000 c.f.s.

Intake.

The intake structure would be situated on the south side of the river at the top of the rock cliff and would necessitate some rock excavation. The whole intake would be built upon a solid rock foundation and be of concrete construction provided with the necessary trash racks; provision would also be made for handling ice under winter conditions. Behind the intake racks, the chamber would narrow down to form the gate chamber or entrance to the penstocks; this would be divided into three exactly similar bays, one for each penstock, having a cross-section of 18 feet by 20 feet at the entrance to the penstocks, and provided with stoplog gains, logs and winches by means of which the entrance to the penstocks may be closed. The whole of the gate chamber would be housed.

Penstocks.

It is proposed to have three separate penstocks from the gate chamber to the power-house in the provisional layout; these would be 10 feet 6 inches in diameter and 210 feet long, each delivering water to one main generator unit, the exciter units being mounted on the shaft of the generator.

Power Station and Equipment.

The site is an ideal one for development, with a high cliff on either side and a flat immediately below which provides a good location for a power station, and plenty of level ground for yard room.

It is proposed to place the power station on this flat immediately below the cliff and excavate the necessary tail-race to the river. By placing the station in this position the penstocks will be short, and good regulation may be secured; also the amount of excavation would be reduced.

The head of 66 feet with the regulated flow of 1,500 second-feet will give a mechanical output of 9,000 b.h.p., or 8,100 electrical h.p.

The equipment would be for three units, the turbines of 4,400 horse-power each, with governors, etc.; the electrical equipment proposed is three 2,500 k.w. generators with exciters mounted on the shaft. All the necessary switch apparatus, wiring, transformers, etc., are provided for, together with a crane of sufficient capacity to handle the station equipment.

ESTIMATE OF COST OF PLANT.

BOW FORT SITE.

General plans have been prepared of the layout of the plant and equipment, and the following is an estimate of the cost of the plant, based upon the foregoing plans, and without transmission line and terminals:—

Main dam and headworks	$366,000.00	
Penstock	54,600.00	
Power-house	65,500.00	
Machinery:		
Turbines and governors	52,800.00	
Generators	65,000.00	
Transformers and switch apparatus	48,000.00	
Total		$651,900.00
Engineering and contingencies	98,530.00	
		$750,430.00
Interest during construction	30,000.00	
Grand Total		$780,430.00

Storage Charges—

Total estimated cost of creating storage above Horseshoe falls	$760,000.00	
On the basis of a minimum flow of 1,500 c.f.s., the total continuous output of the river 47,300 w.h.p.		
Cost of storage per w.h.p.	$16.00	
Proportion of capital cost of storage chargeable to Bow Fort site on basis of w.h.p.	$144,540.00	

Transmission Charges.—

Proportion of capital cost of transmission lines and terminal station and equipment chargeable to Bow Fort site	$ 86,400.00

The total capital cost of the plant, including the proportion of the cost of creating storage and transmission lines with substation and equipment to be charged against the plant, is as follows:—

Estimated total Capital Cost.—

Cost of plant	$780,430.00	
Storage	144,540.00	
Transmission line, sub-stations, equipment, etc.	86,400.00	
Total capital cost		$1,011,370.00

Cost of plant as above, $1,011,370. The head to be developed is 66 feet. This, taken with the regulated flow of 1,500 second-feet would produce 8,100 electrical horse-power, or 7,300 horse-power on the terminals in Calgary for distribution. Under 25 per cent overload, which the machines are capable of supporting continuously, the station output would be 10,125 electrical horse-power.

Annual Charges.—

Assuming the sale of power will reach 7,300 horse-power, the probable annual cost per horse-power will be as follows:—

1.—Interest on capital invested, assuming financing is done on Bonds at 6 per cent, sold at par	$60,700.00
2.—Sinking fund to retire bonds in 30 years reinvested at 4 per cent, say $1\frac{3}{4}$ per cent	17,700.00
3.—Depreciation on plant, adjusted between general works and equipment, to provide for major repairs and renewals	15,150.00
4.—Operation and maintenance, including management, superintendence, wages, for plant, transmission line, receiving stations, etc., proportion of storage, regulation and minor repairs, supplies, etc.	22,750.00
Total annual charges	$116,300.00
Annual operating and fixed charges per horse-power	$15.93
Cost per horse-power year on 50 per cent load factor basis	31.86
Cost per k. w. year on 50 per cent load factor basis or 0 49 cent per k.w. hour.	42.48

MISSION SITE.

General.

Below the Bow Fort site, the river flows through a valley with banks varying from 50 to 150 feet high; the valley bottom is generally wide, and the river meanders through it, swerving from bank to bank so that the banks of the river itself are alternately high and low, a low bank facing a high one and vice versa; this is characteristic of the river from Bow Fort site to the mouth of the Ghost river. At several points there are rocky banks opposite one another, but these are low. At a point on the river, about 4 miles by the river below Morley bridge, two rocky banks occur opposite one another, and opportunity is here afforded for development; this site will be referred to as "Mission Site," owing to its proximity to the old Methodist mission on the Stoney Indian reserve.

Site.

At this point the river flows between two rock outcrops which are parallel to one another about 450 feet apart, and rise to an elevation of at least 60 feet above the river level: this stretch of the river flows almost north and south. On the west side the rock outcrop is in the nature of a long ridge, the ground behind it drops abruptly and then gradually rises to the high banks of the valley behind; here is the controlling feature of the site. On the east side of the river the outcrop forms the bank of the river and also of the valley, and the ground rises gently away from it. At its southern end the outcrop dwindles until it reaches the general level of the large flat adjacent to the river. The general course of the river in the vicinity resembles the letter "S" reversed, the rock outcrops being midway between the two loops. On the south side of the lower loop, the banks are very high while on the north side they are low, gradually rising away from the river in a series of terraces, until an elevation of some 50 feet above the river is reached; these form a bar about 2,600 feet long across the north side of the lower loop beginning at the rock outcrop and ending in a rather steep bank at a point about 6,000 feet downstream, measured along the river, from the two outcrops.

There is no direct fall in the river at this point or above it, the general characteristics being that of swifts or very flat rapids common to the greater part of the river.

The site chosen for the development is that described as above (see reproduction page 55). It is proposed to place a dam across the river between the two rock outcrops, resting against the upstream end of the one on the west side, and near the downstream end of the one on the east side. The lower end of the rock outcrop affords a good site for the intake structure, and the high land running across the loop in the river provides ground at a sufficient elevation to carry the water from the intake and deliver it to a power-house which could be placed on the banks of the river at the end of the loop.

Water Supply.

The remarks on the river flow made in connection with the Bow Fort site apply equally to this site.

Development.

A preliminary examination of the site revealed the foregoing conditions, and it was therefore decided that a detailed survey of the site in connection with the general work in the river was warranted, and from this the scheme of development here outlined has been worked up.

Briefly, the method settled upon involves placing a dam across the river at the rock outcrops, together with some necessary embankment on the west side; an intake structure with controlling devices on the east side; an open canal excavated in the top of the river terrace referred to; a forebay with racks, overflow, and entrance to the penstocks; and penstocks to deliver the water to the power station situated on the banks of the river almost 6,000 feet below the dam.

Head.

The water will be raised at the dam a height of 40 feet, and will back the water upstream a distance of about 4½ miles to a point above Morley bridge; between the dam and the outlet from the power-house there is a further fall in the river of 9 feet, giving a net available head of 47 feet.

Dam.

The proposed dam is similar to that for the Bow Fort site, hollow and of reinforced concrete. It will be 465 feet long, including spillway and sluice-ways, and from the crest of the spillway to the foundation it will be about 55 feet high, and will be founded upon rock. The extra discharging capacity will be provided by means of sluiceways of the same dimensions and type as those at Bow Fort site, but on account of the width of the river, no excavation will be necessary; as above, there will be four 20-foot by 24-foot sluice-ways, controlled by Stoney gates, and provided with proper operating mechanism; two 9-foot by 16-foot stoplog openings will also be provided, together with sluiceway openings, through the base of the dam, 72 inches in diameter. The structure will pass a flood of 50,000 c.f.s. with a 4-foot overtop.

The spillway is placed at elevation 3,865.00, normal water level at the site being 3,825; the bottom of the stoplog openings at elevation 3,856 and the sluice-gate sills at 3,841; an operating deck at elevation 3,871 will be provided for the sluice-way section.

This structure is different from that at Bow Fort site, and the other sites contemplated, in that there is no necessity for a bridge across the dam and the whole length of the spillway will be unobstructed.

This type of structure has many advantages over the solid spillway type, it is cheaper, the difficulties of unwatering are reduced, and the question of foundation is not as serious as with a solid masonry dam.

In connection with the dam it will be necessary to place an embankment on the west side of the rock outcrop, forming the west wing of the dam; here the ground drops about 12 feet below the contemplated spill-way level, the embankment would be 225 feet long on the crest, and at elevation 3,871 or about 16 feet high at the highest point. It is proposed to place either steel sheet piling or a concrete core wall through the centre of this embankment, depending upon the depth at which an impervious stratum of material is encountered. No test pits have been sunk, so that it is impossible to say which will be the proper course to pursue at this stage; ample provision has been made, however, for ordinary contingencies in the estimates.

Intake.

The intake to the canal will be situated at the east end of the dam, and will have its face approximately at right angles to the centre line. This position will secure the advantage of a current across the face of the intake which, with a sluice-way between the intake and the end of the dam, will eliminate trouble usually caused by ice and floating debris lodging against the racks over the

intake. The total width of the intake is 95 feet, divided into four openings of 16 feet wide; the depth of the water at the intake will be 15 feet, and allowing for the loss of section due to trash racks, the velocity of entrance will be about 3.0 feet per second.

In addition to the trash racks it is proposed to place stoplog gains in the intake piers, and also to provide the necessary stoplogs and operating winches. As the structure will be built upon solid rock, means of shutting off the water from the canal will thus be provided, in the event of such a necessity.

The whole structure would have a top elevation of 3,871, or 6 feet above spillway elevation. That is 2 feet above the extreme flood conditions for which the dam structure is designed.

Canal.

The canal proposed is 2,600 feet long; it will have a cross-sectional area of 525 square feet. The whole length of the canal lies in gravel, and on this account the section adopted will have side slopes $1\frac{1}{2}$ to 1. The working level of the water in the canal will be very nearly that of the original surface of the ground for the whole length of the canal, and it is proposed to raise the embankment to elevation 3,871 for the whole length. On account of the nature of the material, it is also proposed to line the canal with concrete for the whole prism, which will not only prevent leakage, and possible breaks, but will materially reduce the loss in head due to friction.

Forebay.

On account of the similarity of their general features it has been decided as far as possible to design the plants for the several sites along the same lines. With this in view, a standard design of forebay has been adopted, for the quantity of water to be handled is practically the same at each site; the penstocks, too, can be made of the same general dimensions.

The delivery of water to each penstock, of which there are three, is obtained by means of a bay 18 feet wide, with a depth of water of 20 feet at working level. Each bay will be provided with racks and screens to prevent the entrance of ice or trash from the canal. The water will be controlled by means of stoplogs for which gains are provided, a duplicate set of gains being also placed in each bay, as it is proposed to use a type of Stoney gate capable of being used in any one of the three bays, so as to obtain rapid control of all the water. Where the forebays are at the end of the canal as in this case, provision is made for draining canal and forebay by means of a sluice-way; this sluice will also take care of any surplus flow due to suddenly closing down of any, or all, of the machines.

The bottom of the forebay, in this case, is at elevation 3,844.5, and the working level of the water 3,864.5, providing for a loss of head in the canal of 0.5 feet.

Penstocks.

The penstocks will be three in number, 10 feet 6 inches in diameter, and 265 feet long, supported upon concrete piers, and will be similar in all respects to the ones proposed for the Bow Fort site, except that they will be slightly longer; very little excavation will be necessary to place the penstocks on a uniform grade.

Power Station and Equipment.

The general layout and size of the power-house as adopted for the Bow Fort site will be used at all the power sites, with the possible exception of the Radnor site, which will enable estimates to be made sufficiently close for the purposes of this report, as the flow is nearly the same for all plants, and the heads to be developed are nearly the same.

The equipment at this will be a slight difference in size from that at the first plant.

The power station would be situated about 100 feet back from the river, at the foot of the terrace mentioned before; the drawback at this point is the lack of evidence of rock in place underlying the heavy gravel which covers the site; on this account care will have to be exercised in securing a foundation for the station. The tail-race will be in the same material, and it may be found necessary to line it with concrete.

The head to be developed at this point is 47 feet and, with 1,500 c.f.s. expected from the regulated flow, 6,410 b.h.p. can be produced, or 5,770 e.h.p. output at the station.

The equipment provides for three units, the turbines each of 3,500 horse-power, with governors, etc.; the electrical equipment proposed is three 2,000 k.w. machines, with exciters mounted on the shaft of each, and these, together with all switch apparatus, wiring, transformers, regulators, etc., are provided for in the estimates. The power station would also be fully equipped with crane, etc. Except for the difference in the capacity of the installation, the station would be similar to that at the Bow Fort site. The size of the equipment has been adapted with the idea that under certain loading conditions two units could handle the total load on the station under minimum flow conditions, giving one unit as a stand-by.

The estimated cost of the development, based upon the layout and plans outlined in the foregoing is here given:—

Estimated Cost of Plant.

MISSION SITE.

Main dam and headworks	$313,660.00	
Canal, including lining	62,000.00	
Forebay	23,000.00	
Penstocks	35,750.00	
Power-house	61,000.00	
Machinery:		
Turbines and governors	42,000.00	
Generators and exciters	52,000.00	
Transformers and switching apparatus	36,000.00	
Total		$625,410.00
Engineering and contingencies	$94,690.00	
		$720,100.00
Interest during construction	$28,000.00	
Grand total		$748,100.00

The total capital cost of the plant, including the proportion of the cost of creation of storage, also the proportion of the cost of a duplicate transmission line to Calgary, and proportion of a transformer station and equipment is:—

Capital cost of plant	$748,100.00	
Transmission lines and station equipment	64,700.00	
Storage	103,000.00	
Total capital cost		$915,800.00

The head available is 47 feet, and the regulated flow 1,500 second-feet, resulting in a power output at the station of 6,410 b.h.p. or 5,300 horse-power at the terminals in Calgary.

Annual Charges.

Assuming a sale of 5,300 horse-power, the probable annual cost per horse-power, based upon a capital cost of $915,800, would be:—

1.—Interest on capital invested assuming financing is done on bonds at 6 per cent sold at par	$54,900.00
2.—Sinking fund to retire bonds in 30 years reinvested at 4 per cent, say $1\frac{3}{4}$ per cent	16,050.00
3.—Depreciation on plant adjusted between general works and equipment to provide for major repairs and renewals	13,700.00
4.—Operation and maintenance including management, superintendence, wages for operators of plant, transmission line, receiving station, storage regulation, minor repairs, supplies, and upkeep, etc	20,650.00
Total annual charges	$105,300.00

Cost of power per horse-power year delivered in Calgary	$19.37
" " " " " on basis of 50 per cent load factor	39.74
" " " k.w. year on basis of 50 per cent load factor, or 0.60 cents per k.w. hour	52.98

Photo by M. C. Hendry.

Mission Site.

GHOST SITE.

General.

The Ghost site (see reproduction page 56), so called on account of its situation at the mouth of the Ghost river, is about 4 miles below Mission site. The river valley between the two points is rather wide, and the banks generally low; this is especially true of the south side of the river, banks a few feet high confining the river to its bed for nearly the whole distance between the two points mentioned; on the north side there are a few low flats lying at the foot of the high banks which form the valley boundaries, these however are generally narrow. On the south side, the land lies all in the Indian reserve, while on the north it is contained in what was Morleyville settlement, of which the Ghost river formed the eastern boundary. This river enters the Bow river at right angles and directly opposite the eastern boundary of the Indian reserve, flowing from the north through a deep narrow valley; where it flows through the valley of the Bow river, before joining that stream itself, its western banks rise in a series of terraces, whilst on the east it flows along the face of a rock cliff, until it joins the main river where the latter cuts through this rock outcrop.

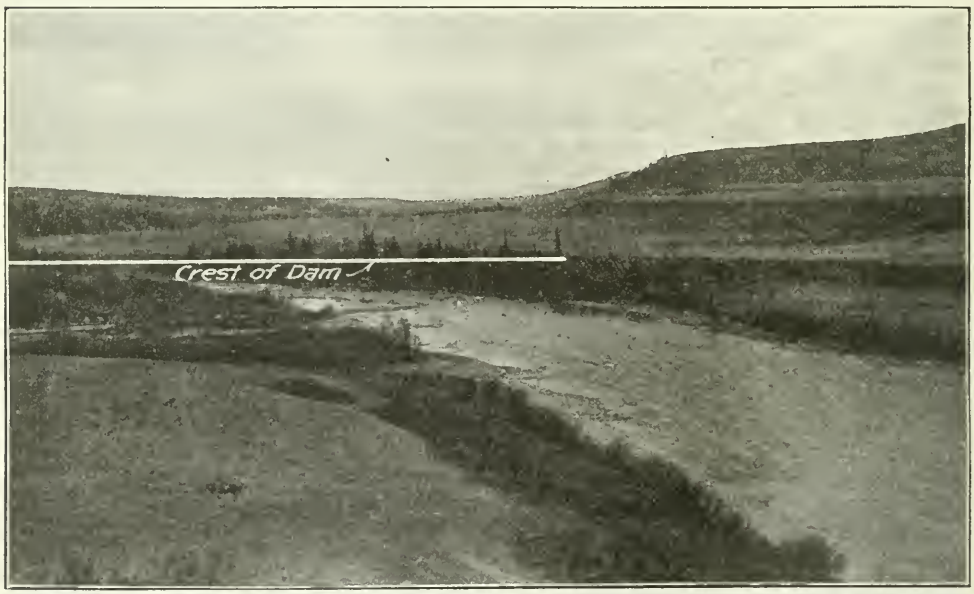


Photo by M. C. Hendry.

Ghost Site.

Site.

The Bow river at the site immediately below the mouth of the Ghost is 300 feet wide. On the south side the river in cutting through the rock has formed a cliff which is nearly perpendicular and about 30 feet high; from the top of the cliff the ground slopes back, gently rising at least 20 feet more in about 400 feet; on the north side the banks rise higher, but are not so abrupt, the rock rises from the river to a flat at the foot of the high valley bank. This rock ridge observed on either side the river, extends right across the bed, causing quite a noticeable fall in the river at this point.

Development.

The scheme proposed is to place a dam across the river at this point, with the rock outcrops as abutments. In this position it will intercept not only the flow of the Bow river, but also that of the Ghost, and this has an important bearing on the scheme, by raising the water to the proposed level, the present road and bridge over the Ghost will be flooded out, making it necessary to relocate them; this may be done quite easily by diverting the road north before it leaves the upper level, and an easy grade down to the Ghost river above the proposed flood level may then be secured, also a good crossing point. The road will then follow the new bank of the river downstream until it joins the old road; this route, which is marked out, and may be seen on the plans, will cost very little and will not increase the length materially.

The intake will be placed upon the south side of the river, and will give entrance to a canal similar to the one proposed for the Mission site, though not as long. At the lower end will be placed a forebay and penstocks, leading to a power station and tail-race. By this means some 6 or 8 feet of fall in the river will be added to the head utilized, for an expenditure which is considered to be warranted.

Flow.

The regulated flow of the Bow river will be augmented at this point by the flow from the Ghost. The records of the discharge of the latter river do not extend over a lengthy period, only two years being available, but records at other places extending over a longer period, indicate that the winter of 1911-12 was one of low flow, and from the records it is concluded that a minimum flow during the low water period will be approximately 100 c.f.s. This will, with the storage contemplated, give an available minimum discharge at the proposed power site of 1,600 c.f.s.

Head.

The head it is proposed to develop will be secured by raising the water at the dam to an elevation of 3,812.50 and by going downstream a sufficient distance to get a tail-water elevation of 3,762, or a net available head of 50 feet. This head, together with the contemplated minimum flow of 1,600 c.f.s. will give an output of 7,275 b.h.p. an output at the station of 6,550 e.h.p.

Dam.

The dam contemplated in connection with this scheme is similar to the two already described in connection with the developments proposed at the Bow Fort and Mission sites, *i.e.*, a hollow reinforced concrete dam. The structure will be 450 feet long, including sluice-ways, and about 50 feet high, depending upon the depth of the foundation. The dam proper, will be approximately 300 feet in length, the remainder being taken up with sluice-ways, which will be placed at the north end of the dam. Some excavation will be required, in order that the sills for the large openings may be placed at the required elevations, and provide for entrance and exit for the water; the openings proposed are the same as at other sites, four 20-foot by 24-foot sluice-ways controlled by Stoney gates, and two 9-foot by 16-foot stoplog openings. Access to the north end of the dam will be by means of a passageway through the structure, leaving a clear spillway 300 feet long; in addition, sluices will be provided through the dam at the south end, controlled by 72-inch valves, giving in all a discharging capacity of 50,000 second-feet., the dam being designed for a 4-foot overtop.

At the north end of the dam an embankment 300 feet long and 8 feet high will be required, and one also at the south end of the intake, to connect it to high ground; the latter will be 400 feet long and of a maximum height of 8 feet.

Intake.

The intake to the canal will be at the south end of the dam, a sluice-way for ice and other debris intervening; the face of the intake in the proposed lay-out is at an angle of about 30° with the line of the dam, producing a cross current towards the sluice-way mentioned. The intake will be about 100 feet over all, and will be provided with five 16-foot openings, the openings to be provided with proper racks and screens to exclude ice and debris; the depth of water will be 14.5 feet to obtain which, rock excavation will be necessary, as the whole structure will have a rock foundation. With the design proposed, the entrance velocities will be low being only about 2.5 feet per second.

The piers in the intake will be provided with stoplog gains; stoplogs and operating machinery are also provided for, in order that the water may be shut off from the canal if necessary, the piers being designed with that contingency in mind.

The top of the structure will be at elevation 3,818.5, or 6 feet above working level; thus these head-works are 2 feet above extreme flood level, the dam being designed for a maximum overtop of 4 feet.

Canal.

The canal proposed will be 1,900 feet long; from the intake it will be entirely in excavation, the material being solid rock and earth in about equal quantities.

As indicated on the layout of the plant, it is assumed to be all in earth, but the estimates are based upon the assumption of rock forming 50 per cent of the excavated material.

The earth is really gravel mixed with loam, and the material being porous, a concrete lining has been provided for the whole length of the canal.

The section in the different material will be so adjusted as to obtain an area in cross-section of at least 525 square feet, giving a mean velocity in the canal, under working conditions, of from 3 to 4 feet per second.

Forebay.

From indications on the ground it is expected that a solid rock foundation may be obtained for the forebay and power station.

The forebay will be similar in every respect to that at the Mission site; it will be provided with the three penstock bays of the same size controlled by stop-logs and auxiliary stoney gate, capable of use in any one of the three bays. The overflow sluice will also be the same as for the Mission site.

Penstocks.

The penstocks will be 250 feet long, and of the same dimensions as for the other sites, *i.e.*, 10.5 feet in diameter, being under practically the same head. The other dimensions will be the same in every respect.

Power Station and Equipment.

The power station will also be similar to the one at the Mission site, both in the building itself, and the equipment. It is proposed to use three 3,500 horse-power turbines with governors, etc., and three 2,000 k.w. generators with

exciters direct connected as before; also similar switch apparatus and transformer equipment.

The size of the units selected has the advantage of leaving a spare unit available. Two of the turbine units under capacity load are practically equal to the output of the station under low water conditions; under these conditions, the generators would be working under a 25 per cent overload, which they could maintain indefinitely; this may be said for all the developments, the stations being designed with that end in view.

Estimated Cost of Plant.

GHOST SITE.

Main dam, including embankments, excavation and unwatering and headworks	$349,800.00
Canal	71,000.00
Forebay	17,275.00
Penstocks	32,000.00
Power-house	54,000.00
Machinery:	
Turbines and governors	42,000.00
Generators and exciters	52,000.00
Transformers and switch apparatus	36,000.00
Total	$654,075.00
Engineering and contingencies	98,891.00
	$752,966.00
Interest during construction	30,000.00
Grand total	$782,966.00

The total capital cost of the plant, together with its proportion of the cost of creating storage based upon the 1,500 c.f.s. flow, also the proportion of the cost of a duplicate transmission line and terminal station with equipment, etc., is as follows:

Total cost of plant	$782,966.00
Transmission line, sub-station with equipment, etc.	70,577.00
Storage charges	109,530.00
Total capital cost	$963,073.00

The head available is 50 feet; the regulated flow is 1,500 second-feet, to which must be added 100 second-feet, which is the discharge from the Ghost to be counted upon during low-water period, giving a total of 1,600 second-feet; the power to be developed is, therefore, 7,275 b.h.p., giving an output of 5,900 horse-power on the terminals at Calgary.

Annual Charges.

Assuming a sale of 5,900 horse-power, the probable annual cost per horse-power based upon a capital cost of $963,073. would be:—

1.—Interest on capital invested assuming financing is done on bonds at 6 per cent, sold at par	$57,825.00
2.—Sinking fund to retire bonds in 30 years, reinvested at 4 per cent, say 1¾ per cent	16,875.00
3.—Depreciation on plant adjusted between general works and equipment to provide for major repairs and renewals	14,475.00
4.—Operation and maintenance, including management superintendence, wages for operation of plant, transmission line, receiving station, etc., proportion of storage regulation and minor repairs, supplies and upkeep chargeable to income	21,625.00
Total annual charges	$110,800.00

Cost of power per h.p. year, delivered in Calgary	18.73
" " " " " " on a basis of 50 per cent load factor	37.56
" " " per k.w. year on the same basis	50.09
or 0.57 cent per k.w. hour.	

RADNOR SITE.

General.

Below the mouth of the Ghost, the Bow river flows generally between high banks; on the north side they rise to a considerable elevation above the surface of the river, while on the south side they are not so high, rising about 20 to 30 feet, and sloping back to the general valley boundaries. The next section does not contain any direct falls, but is made up of swifts, rapids and the general slope of the river, so that any development would simply mean the concentration of the natural slope in the river at one point.

Site.

The last site upon the power producing section of the river settled upon is that known as "Radnor site" (see reproductions pages 62 and 63), lying about 3½ miles below the mouth of the Ghost river. The banks of the river at the point chosen are about 300 feet apart, and are in the nature of rocky cliffs; on the south side they rise almost perpendicular to a height of about 50 feet; on the north side they are not so high, but rise about 35 feet and from that height slope back gently reaching a height of nearly 60 feet above the surface of the water. At the point chosen for building the dam, there is a ridge which extends entirely across the river causing a slight drop at that point. Directly below the site the river makes a sharp bend to the north, then swings east again and is divided into two channels by an island a few hundred yards below.

On the south side, the Canadian Pacific railway approaches very closely to the bank of the river, but is at a sufficient elevation to obviate the possibility of trouble due to placing a dam at the point mentioned. The proximity of the railway to the site facilitates the transportation, and by building an overhead cable from the railway, material could easily be transferred to the works.

Above the site the banks are generally high though the flats along the river are wide, and considerable flooding in the river bottom will occur; the total area of the pond created being 241 acres; the slope of the river is generally regular, there being only a few flat rapids or swifts between this and the mouth of the Ghost.

Development.

The method of developing the site involves placing a dam across the river at the point mentioned, and making use of the rock cliffs as abutments for the structure.

The intake which will be in the nature of a short canal, will be placed upon the north side of the river, being excavated from the side of the cliff forming the river bank and extending downstream past the dam about 300 feet. Its inshore bank will be formed of rock in excavation, and on the river side it will be confined by a concrete retaining wall designed to act as an additional spillway.

The forebay or entrance to the penstocks, will be placed at the lower end of the intake or canal and will lead to penstocks of short length, which in turn will convey the water to the power station situated on the river bank opposite the second bend in the river below the dam (see plans.)

Flow.

The flow upon which the development is based is the same as that for the Ghost site, that is, a minimum of 1,600 c.f.s. with structures designed to discharge a flood of 55,000 c.f.s., with an overtop of 4 feet.

Head.

The head it is proposed to develop will be secured by raising the water at the dam to an elevation of 3,760; the normal tail-water opposite the site of the power station is 3,716, so that the normal working head will be 44 feet; this head with the contemplated regulated flow of 1,600 c.f.s. minimum will give an output of 6,400 b.h.p. or an output at the station of 5,760 e.h.p.

Dam.

The dam upon which the estimates have been based, is the hollow reinforced concrete type similar to the structures already described in connection with the other sites. The dam will be connected to the spillway section forming the retaining wall for the intake, and as access to the south shore may be had through the dam, no deck will be necessary; this will give an unobstructed spillway of approximately 700 feet, which, together with the two 18-foot by 20-foot sluice-ways that it is proposed to place next the forebay, will give ample discharging capacity. Provision may be made for a log run at the south end of the dam.

Intake.

The intake will be on the north side of the river and will be in the nature of a canal, the entrance being in line with the upstream face of the dam: it will be 50 feet wide and excavated to a sufficient depth to provide 20 feet of water with the upper water surface at normal working level; this canal will be about 300 feet long, and at the lower end sluice-ways and an ice channel will be provided to clear any ice that may lodge against the racks, protecting the entrance to the penstocks. The entrance to the intake will be protected by a timber boom swung across from the bank to the north to deflect all logs and debris over the main spillway.

Forebay.

The forebay will be in every respect similar to those of the other sites, providing for entrance to three penstocks by means of bays 18-feet by 20-feet,

the water being controlled by means of stoplogs. Duplicate stoplog gains are provided and provision made for closing the openings rapidly by means of a type of gate similar to the Stoney gate but mounted on a track, and capable of being used in any bay, or in the sluice openings provided in the spillway.

Penstocks.

The penstocks, three in number, and each leading to one unit, will be 10.5 feet in diameter as before, and about 75 feet long, and as the head is nearly the same as for the plants already mentioned, their other dimensions will be approximately the same.

Photo by K. H. Smith.

Radnor—Power Station Site.

Power Station and Equipment.

The power station will, as already stated, be placed upon the river bank opposite the second bend below the dam, (see reproduction, page 63), and an unobstructed flow of the water from the tail-race will be thus provided for. The building will be founded upon rock and be similar in all respects as to equipment and design to the stations at Mission and Ghost sites. The equipment will consist of three 3,500 horse-power turbines direct connected to three 2,000 k.w. generators, and having exciters mounted upon their shafts, together with switch apparatus, transformers, etc.

At the north end of the station, yard room will be provided by filling in over the old gravel bar shown on the plans, up to the floor level of the station; this will provide room for assembling and handling the plant.

Tail-Race.

The tail-race, owing to the depth of water in front of the station, will be short, little excavation being necessary.

Estimated Cost of Plant.

RADNOR SITE.

Main Dam, including excavation and unwatering	$ 295,000.00
Intake, including excavation, concrete and fixtures	64,700.00
Forebay	23,800.00
Penstocks	11,400.00
Power Station, excavation and unwatering	68,100.00
Machinery:	
Turbines, governors, etc	42,000.00
Generators and exciters	52,000.00
Transformers and switch apparatus, etc	36,000.00
Total	$ 593,000.00
Engineering and contingencies	90,750.00
	$ 683,750.00
Interest during construction	27,350.00
Grand total	$ 711,100.00

Photo by K. H. Smith.

Radnor Site (From Upstream).

Total Capital Cost.

The total capital cost of the development includes the cost of constructing the plant, the proportion of the cost of creating storage chargeable to the plant on the basis of horse-power developed (b.h.p.) from 1,500 c.f.s. and the proportion of the cost, on a basis of output e.h.p., of a duplicate transmission line to Calgary, together with substation and equipment of a capacity sufficient to serve the four lower plants. It is made up as follows:—

Cost of the plant	$ 711,100.00
Transmission line, substation, etc	62,400.00
Storage	96,360.00
Total capital cost	$ 869,860.00

Annual Charges.

The head available is 44 feet; the regulated flow 1,500 c.f.s., to which must be added 100 c.f.s. from the Ghost river, giving a total minimum flow of 1,600 c.f.s.; the power developed would be 6,400 b.h.p., giving an output on the Calgary terminals of approximately 5,200 horse-power.

Assuming a sale of 5,200 horse-power, the probable annual cost per horse-power based upon a capital cost of $869,860 would be:—

1.—Interest on capital invested assuming financing is done on bonds at 6 per cent, sold at par	$52,200.00
2.—Sinking fund, to retire bonds in 30 years, reinvested at 4 per cent, say $1\frac{3}{4}$ per cent	15,250.00
3.—Depreciation on plant, adjusted between general works and equipment to provide for major repairs and renewals	13,050.00
4.—Operation and maintenance, including management, superintendence, wages of operators at plant, transmission line, terminal station, operation of storage, minor repairs, supplies, upkeep, etc., etc	19,600.00
Total annual charges	$ 100,100.00

Cost of power per horse-power year delivered in Calgary	$19.25
Cost per horse-power year on basis of 50 per cent load factor	38.50
Cost per k.w. year on basis of 50 per cent load factor	51.33

or 0·59 of a cent per k.w. hour.

Cascade Power Development.

When contemplating the creation of storage on lake Minnewanka, the question was raised as to whether it would be feasible to build a power plant in connection with the storage scheme and produce electrical power for consumption in Banff. Banff, together with the storage basin and drainage area developed, lies entirely within the boundaries of Rocky Mountains park, and as the affairs of the town are administered by the Dominion Government, through the Parks Branch, Department of the Interior, the same authorities should carry out the work; surveys were accordingly made with this end in view.

General.

The canyon of the Cascade river, in which it is proposed to develop power, lies directly below the junction between the Cascade and Devil's creek, the latter forming the outlet of lake Minnewanka. The area tributary to the river at this point is approximately 220 square miles, of which lake Minnewanka forms about 6 square miles. The greater portion of this basin lies at considerable altitudes, the entire water supply coming from mountain streams, springs, and glaciers.

At the entrance to the canyon (see reproduction, page 66), and just below the confluence of the two creeks, a dam was built last year to produce storage upon lake Minnewanka and improve the power facilities of the Bow river.

The site of the proposed power plant is about 7 miles from the town of Banff; communication with the latter place being had by means of a well-kept and travelled road; this road, which also passes through Bankhead, the nearest point on the railroad about 3 miles distant, terminates at the lake.

Water Supply.

Any development at this point will be entirely under the jurisdiction of the Government, as the whole project lies wholly within the Rocky Mountains park, so that all privileges such as land, water, rights of way, are vested in the Crown. The natural conditions on the river no longer apply, since the storage and regulation works are complete and in operation, but the influence of these works upon the operation of a power plant at the point contemplated will, however, be entirely beneficial.

When the agreement was entered into between the Minister of the Interior and the Calgary Power Company, it was expected that the company would not be the only beneficiaries from the storage created, but that it was possible other plants might be built upon the river and receive benefits, a clause was therefore inserted in the agreement enabling the Minister to control the operation of the dam; this clause says:—

> "The company shall after the completion of the dam, maintain and operate the same to the satisfaction of the Minister. . . ."

In connection with the necessary discharge of water from storage, sub-clause "*d*" of clause 17 reads:—

> "The company shall, if required by the Minister, allow a minimum amount of water of 150 cubic feet per second to pass through the dam, which the Government may use for power purposes within the Rocky Mountains park; and the release of such water through the dam shall at all times be under the full control of the Minister or person or persons duly authorized by him for that purpose."

Any development on the Cascade below the dam, will therefore be assured of a minimum flow of 150 second-feet.

During the early part of the flood season, the storage of water will take place; this will, it is expected, be completed not later than July 15 in any season, after which date water will be wasted over the dam. A flow greater than 150 second-feet is practically assured during part of July, August and September, so that the greatest power would be available during the summer months, when the tourist traffic is greatest and the consequent power load heaviest—a very fortunate combination of circumstances.

Available Power.

At the instance of the department, provision was made during the construction of the storage dam to use the structure as a head works for the contemplated power plant below; the dam produces at least half the head to be developed, the other half being due to the natural fall in the river between the dam and power site. As the pond above the dam is primarily for storage purposes, there will necessarily be fluctuation in level; this will not, however, affect the head unfavourably, for the low working head will occur during the winter months, during which period the load will be small. A study of the question of water supply has been made and the conclusions reached have been included in another portion of the report.

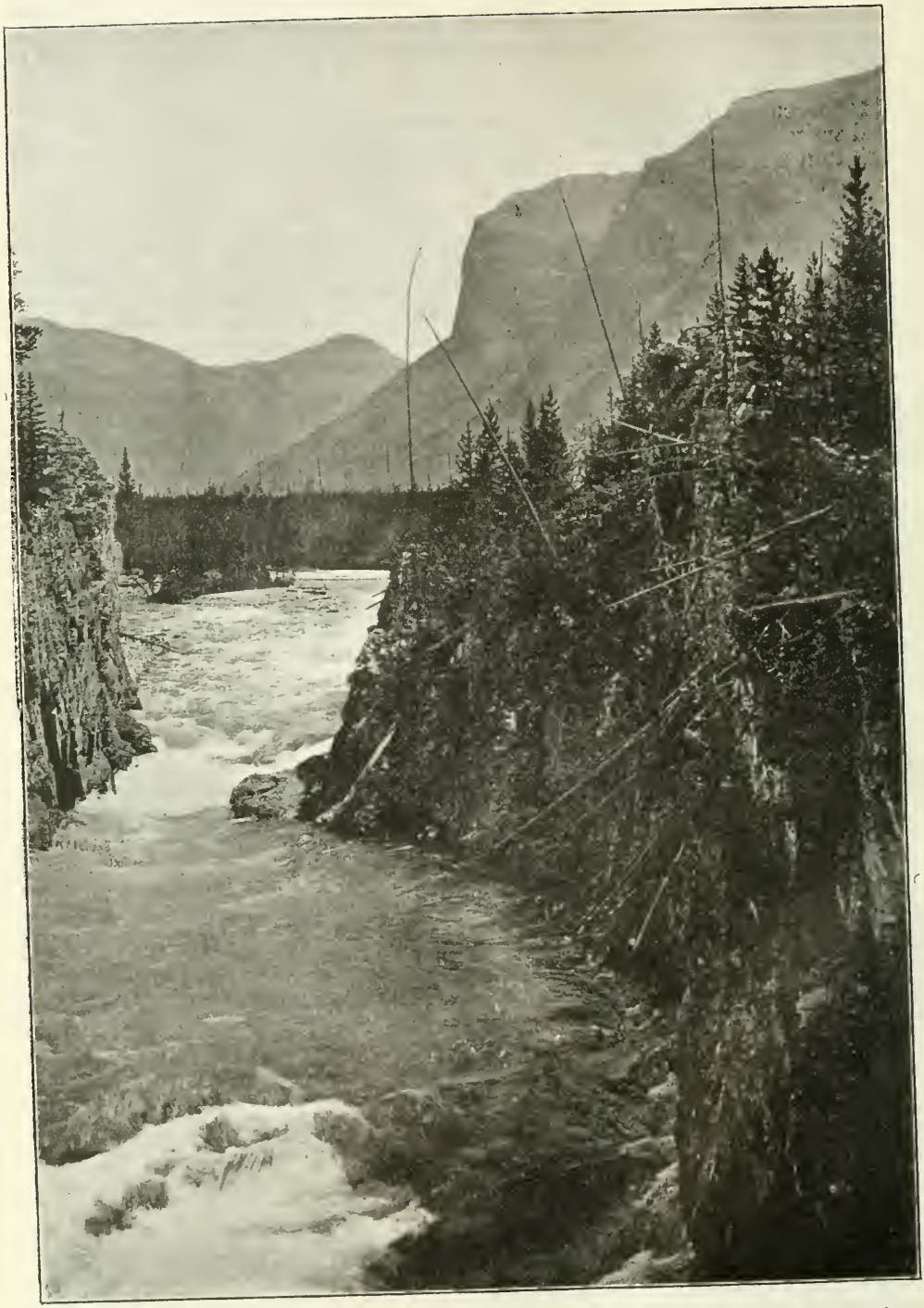
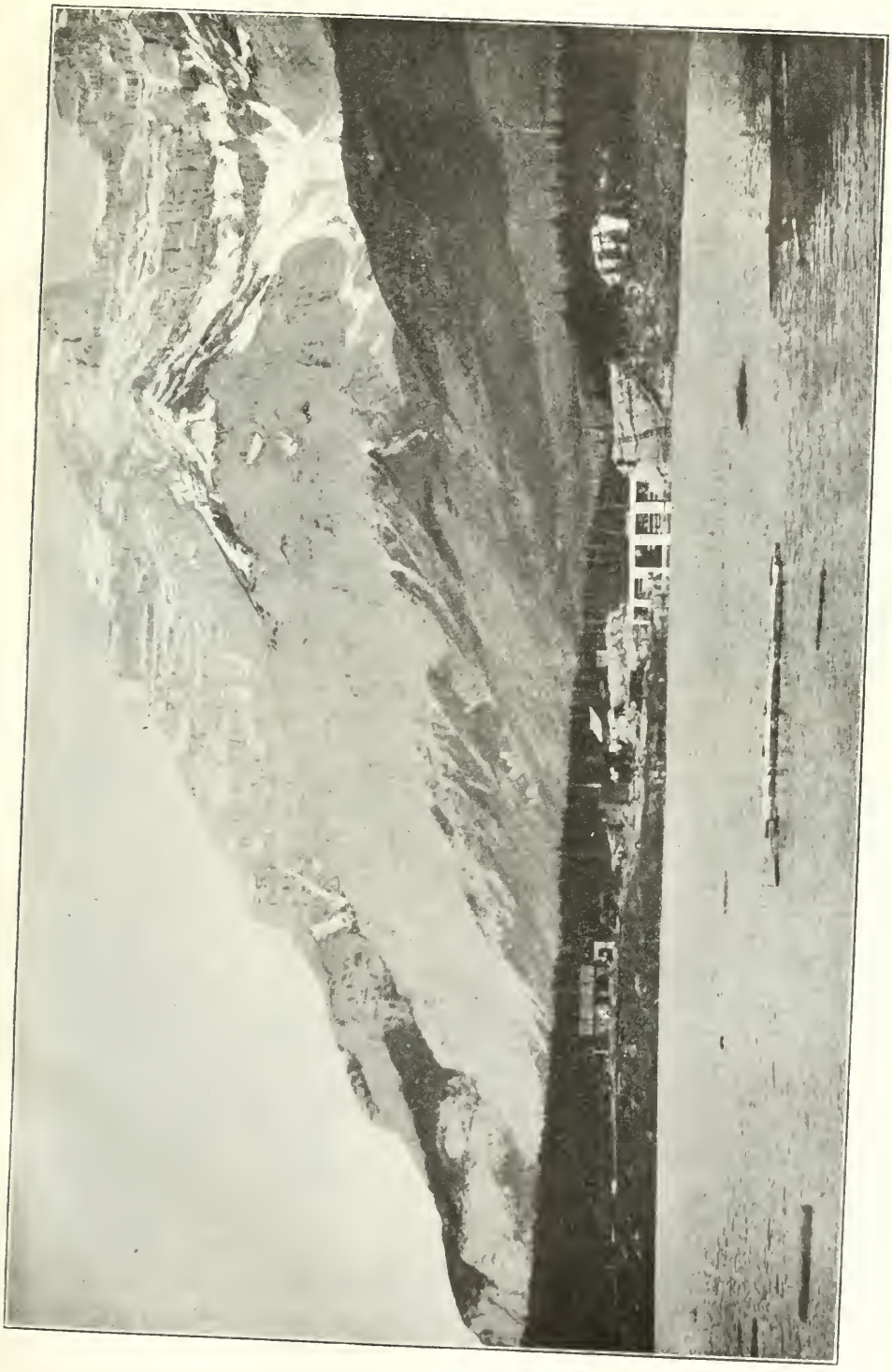


Photo by M. C Hendry.

Devil's Canyon, before Construction.



Devil's Canyon Dam (View from Basin).

Photo by K. H. Smith.

The plant should be designed to meet the requirements during the summer by utilizing the maximum head and a flow of 200 cubic feet per second.

The available head when the storage basin is full will be 64 feet, of which 60 feet may be assumed to be the effective head; with this head, and a flow of 200 second-feet, an electrical output at the station may be secured of at least 900 horse-power, of which 825 could be delivered in Banff ready for delivery to consumers. Owing to the loading conditions imposed, this flow of 200 c.f.s. could not be utilized continuously, and hence an overdraft for peak loads would be available, say up to 330 c.f.s., and it is upon this basis of flow that the proposed development is worked out.

Under the method of development contemplated, it is proposed to construct all the general works, such as power station, tail-race, etc., for the full capacity of the plant, but only sufficient equipment will be placed in the station at the present time to develop two-thirds the proposed station capacity, the remainder to be added as the demand warrants.

Method of Development.

Dam.

The dam at the upper end of the canyon (see reproductions, page 69) to be used as an intake is of concrete masonry construction, and is provided with means for discharging water either through stoplog spillways, or through a low level sluice-way controlled by a gate valve.

At one side of the canyon, one of the stoplog openings was, on the instance of the department, modified to be used as an intake to the penstock, provision being made for screens, and a steel thimble 5 feet in diameter inserted in the opening to provide a connection to the penstock. This thimble is set at such an elevation that the water may be drawn down in the basin without breaking the water seal on the entrance to the penstocks. At this stage, it should be pointed out that the power project begins at the outside end of the thimble; the cost of the dam, thimble, etc., being charged against the cost of creating storage.

Penstock or Flume.

The penstock connecting to the thimble, will lead along the cliff for a short distance, and then enter a tunnel driven in the rock along the south side of the canyon; the tunnel will be 7 feet by 7 feet in section, concrete-lined to reduce friction losses, and will connect with a steel penstock so designed and placed as to provide an unsupported crossing of the river at this point. After crossing the river, the steel penstock will join one of wood, 7 feet in diameter, which will convey the water to a point just outside the power-house, it will be under pressure, and generally in cut, though for a length of approximately 150 feet it will be carried above the ground on concrete piers.

The lower end of the penstock, at the power-house, will be an 8-foot diameter steel pipe, from which the necessary connections to the turbines will branch. These branches will be fitted with valves to control the flow, and the steel section will terminate in a bend, leading up the bank to a steel surge tank built upon the side of the hill. The tank will be approximately 12 feet in diameter, and of such a height as to be above the highest level of lake Minnewanka, and thus prevent spilling. This tank will provide sufficient hydraulic regulations in the operation of the long pipe line.

Power Station.

The power-house, which will be placed in part of the present river bed, (see reproduction, page 71), will be of concrete construction, and will be protected on the river side by a wall both upstream and downstream from the

Photo by M. C. Hendry.
Devil's Canyon Dam (Downstream View). Summer.

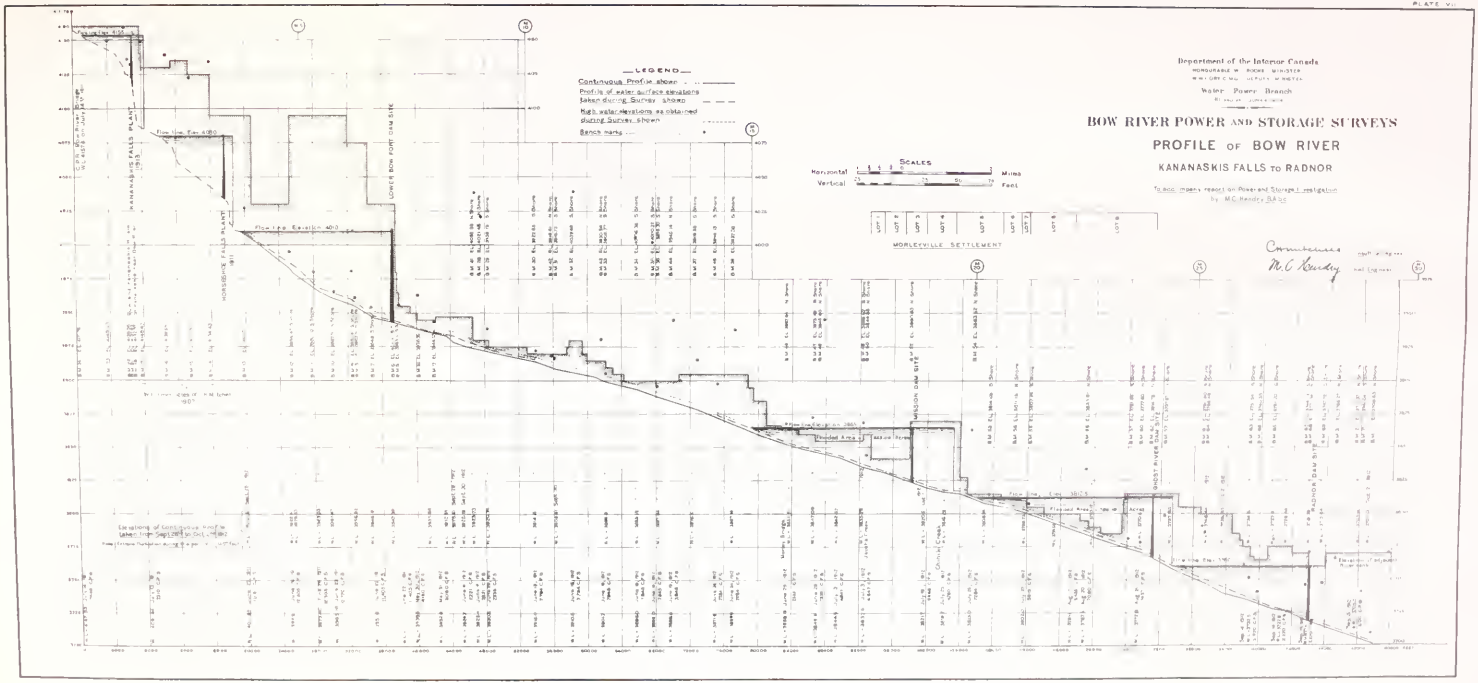
Photo by M. C. Hendry.
Devil's Canyon Dam (Downstream View). Winter.

power-house. Behind the upper wall the ground will be filled in, affording yard space, and access to the Banff road will be had by a road leading by easy grades up the hill.

Equipment.

The equipment will consist of three units. The turbines being each of 600 horse-power capacity direct connected to 350 k.w. generators, the latter having exciters mounted on the outer end of the shaft. The generators will be connected through the necessary switch and protecting apparatus to the transmission line, no step up transformers being necessary.

It is proposed to install two units at first, one of which will act as a stand-by, the third will be added when the power load demands it.



Department of the Interior Canada
HONOURABLE W. ROCHE MINISTER
W. W. CORY C.M.G. DEPUTY MINISTER
Water Power Branch
R. J. GIBBON COMMISSIONER

BOW RIVER POWER AND STORAGE SURVEYS

PROFILE OF BOW RIVER

KANANASKIS FALLS TO RADNOR

To accompany report on Power and Storage investigation
By M.C. Hendry S.A.D.C.

Commenced [illegible] 1910
M.C. Hendry

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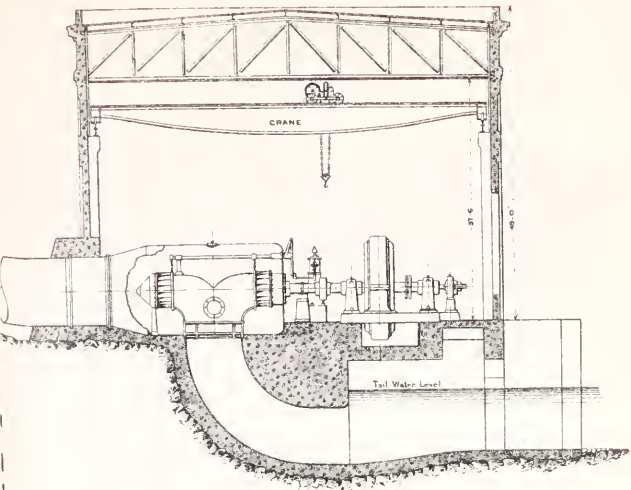
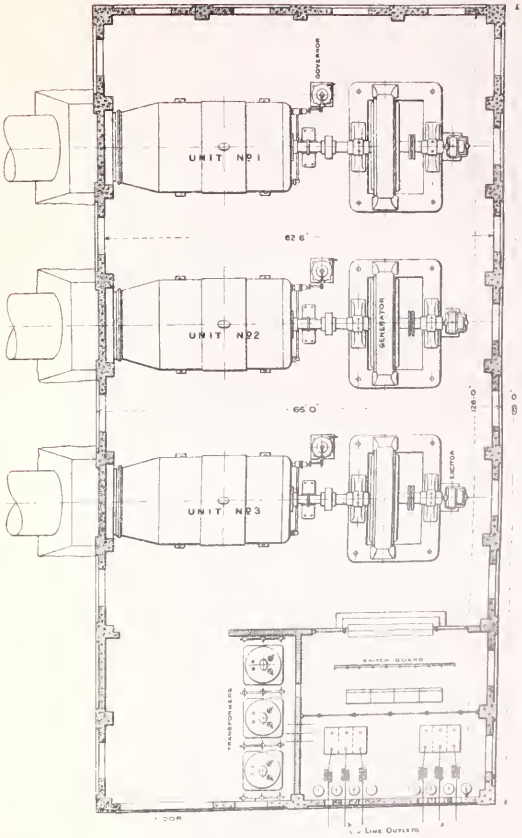


SECTION



PLAN

Department of the Interior, Canada

HONOURABLE W J ROCHE, MINISTER.

W W CORY, C M G, DEPUTY MINISTER.

Water Power Branch

J B HALLIES, SUPERINTENDENT

BOW RIVER POWER AND STORAGE SURVEYS

PLAN AND SECTION OF TYPICAL POWER-STATION

July 1913

M. C. Hendry. CHIEF ENGINEER

Scale of feet.

CHAPTER VIII.

STORAGE.

General.

In 1909, work was commenced upon the plant of the Calgary Power Company at Horseshoe Falls, though it was not until the winter of that year that actual gaugings were made of the river during the low water period, and not until the winter of 1910-11 that continuous readings were kept of the discharge.

During January and February, corresponding to the time of minimum flow, fairly complete records were kept; these corroborated the few readings made the previous winter, and revealed a state of affairs that, to say the least, was alarming. These records gave a mean minimum monthly flow of 741 second-feet for the month of February, 1911, and showed that an actual minimum discharge of less than 600 second-feet could be expected for short periods.

The plant built had a turbine installation, capable of an output of 7,500 b.h.p., with provisions to bring it up to 19,000 b.h.p. The situation was, therefore, a serious one for, under existing conditions, during six months of the year water was going to waste, while for the remainder of the year, owing to lack of water, a greater part of the plant would stand idle. The demand for power was meanwhile rapidly increasing, the only remedy was storage. By impounding a portion of the water wasted during the flood stage of the river, the low-water flow could be augmented and the situation very materially relieved; the loss due to idle machinery would then be prevented.

Photo by C. H. Mitchell.

Cascade River Power Station Site.

Curves have been prepared, and are embodied in the report which describes graphically the situation.

The whole basin of the Bow river was examined with a view to storage. During the first season a reconnaissance was made of the site most likely to prove satisfactory, the less likely ones being left until the next season. From the reconnaissance of 1911 it was decided that Spray lakes, lake Minnewanka and Bow lake were likely to prove suitable.

A party was sent up to Bow lake in August, and made a survey there, the results of which are given further on. After completing that work it was moved to Lake Minnewanka and made a survey of that basin.

In the summer of 1912, Spray Lake basin was also surveyed, and an examination made for storage of a number of tributaries of the Bow, these proved unsuitable.

A survey was made of the Ghost river for a distance of about 4 miles from its mouth to ascertain the extent to which the river might be used as an auxiliary storage basin. The survey proved that, while a basin might be created, the cost of development would be high and the scheme was one only to be considered as a regulating possibility in connection with plants below the mouth.

Photo by M. C. Hendry.

Devil's Creek (Old Dam).

Storage Basins.

The basins that have been and may be developed are therefore:—

1. Minnewanka lake. (developed).
2. Spray lakes.
3. Bow lake.
4. Elbow river storage basin.

Lake Minnewanka.

After the general examination of the Bow drainage basin, lake Minnewanka was settled upon as affording the cheapest, most accessible and easiest developed

storage basin. A survey of lake Minnewanka was made by the Calgary Power Company with this object in view.

In the meantime, a policy of conservation and investigation had been formulated by the Railway Lands Branch, Department of the Interior, which at that time handled matters relating to water-power, regarding the question of water-power and storage. This branch commenced active work in this district in the spring of 1911; after a study of the situation, and considerable work in the nature of reconnaissance, a conclusion was reached by the engineers, which, while entirely independent, was practically the same as that of the engineers employed by the Calgary Power Company, namely, that storage on lake Minnewanka offered the most immediate relief to the power situation. Towards the end of the summer of 1911, a party was sent in to make surveys of the lake to determine what amount of storage could be economically obtained, the amount of land to be flooded, and, in short, all the necessary information that would enable the branch to deal with the matter; the notes were worked up in the office during the winter of 1911-12, and plans and computations made.

The power situation on the Bow river was rapidly becoming worse, though the records for 1911-12 did not show quite such low water as for the previous year; the market had increased, besides, this slight improvement was not a permanent one. Fortunately when the company asked for certain rights, the branch, owing to the work done in the field, had the situation thoroughly in hand, and was in a position to discuss the situation with the company's representatives, and make certain recommendations based upon information obtained by its own officers.

Owing to the urgency of the situation, it was desirable to obtain an increased flow for the low-water season of 1912-13, and to do this, the high-water run-off during the summer of 1912 would need to be impounded; expedition on the part of all concerned was therefore necessary, prompt action on the part of the branch in granting licence to the company to create storage and prompt action on their part in getting to work.

The policy the branch has had in mind was the control and building of any storage scheme, but this policy had not advanced to the state where the branch was prepared to take up the actual construction and control of storage; as the situation demanded speedy action, and as only the benefit for the present was to the Calgary Power Company the actual building of the necessary works was left to that Company.

Agreement of Development.

An agreement was therefore entered into between the Calgary Power Company and the department, whereby the Company was permitted to create storage upon lake Minnewanka, subject to the control of the department; the amount of storage to be created, limiting elevations, discharge, etc., were fixed and, further, a clause was placed in the agreement whereby the work might be taken over by the department at any time on paying to the company the cost of the work, as determined by the departmental engineer. These particular points are set forth in clause 17, subsections "*d*," "*e*" and "*j*" of the agreement, which reads as follows:—

> "(*d*) The company shall, if required by the Minister, allow a minimum amount of water of 150 cubic feet per second to pass through the dam, which the Government may use for power purposes within the Rocky Mountains park; and the release of such water through the dam shall at all times be under the full control of the Minister or person or persons duly authorized by him for that purpose.
>
> "(*e*) The company shall not raise or reduce the elevation of lake

Minnewanka beyond such limiting elevations as the Minister may from time to time determine are sufficient to supply forty-four thousand (44,000) acre-feet of storage.

"(*j*) The Government shall have the right upon giving the company sixty days' notice in writing of the intent to do so, to take over, control and operate the said dam upon the payment to the company of the actual reasonable cost to the company of the said dam and of all work required to be done in the Rocky Mountains park pursuant to said clause twelve (12)."

Storage Basin.

Lake Minnewanka offered a splendid site for storage, and one capable of very economical development. Situated in the Rocky Mountains Park, and in close proximity to Banff, it required careful treatment in order that its value as a resort for tourists would be enhanced rather than damaged. The lake is the largest to be found in the Rocky Mountains Park, it is 9½ miles long, and averages over half a mile in width; the waters are very beautiful, being exceptionally clear and of a very deep blue, and surrounded as it is by high mountains, many approaching 10,000 feet, it offers great attraction to the many tourists that visit the region during the summer.

The lake has an area of 5.37 square miles. The banks are generally quite steep, and are for the most part from 15 to 20 feet high, though in places they rise gently to the slope of the surrounding mountains, having a narrow beach at the water's edge. The lake is very deep, and in consequence the shores slope off rapidly into deep water. The south shore is heavily wooded for its entire length, while the north shore is clear of timber in many places; the outlet end of the lake is low, a considerable area being but 2 or 3 feet above the original lake level. Devil's creek forms the outlet of lake Minnewanka; it is a little over a mile in length, and joins the Cascade river at the entrance to Devil's Canyon, which is a narrow gorge in the solid rock, about 500 feet long; at the entrance, this gorge was about 40 feet between rock walls, and 50 feet deep. (See reproductions, pages 66 and 75.) About a quarter of a mile from the outlet of the lake, an old dam existed, which kept the water at lake level, or 4 feet above its former natural level. From the foot of the dam to the mouth of the canyon the fall was 14 feet. A dam placed at the entrance to the canyon would have a double advantage—the natural run-off of the lake would be stored, and also the discharge of the Cascade river, the lake being used as a storage basin for both.

Capacity.

After a study of the plans made, it was considered that storage to a depth of 12 feet upon the lake was feasible, this depth meant the flooding of a considerable area at the lower end of the lake and in the Cascade valley, rendering necessary the diversion of the road, the replacing of a bridge, the moving of some houses to higher ground and also the building of a new dock, with slips for the boats on the lake, all of which could be done at comparatively small expense.

The area of the lake at normal level is 3,449.8 acres, and the area within the 12-foot flood line is 4,009.9, thus the area flooded at the lower end of the lake is approximately 600 acres. The storage in round numbers is 44,000 acre-feet. (See diagram, Plate No. 9 for effect upon flow at Horseshoe falls.)

Discharge.

Records of the discharge of Devil's creek and the Cascade river have been taken more or less continuously since 1910. A gauging station was established

BOW RIVER
AT
HORSESHOE FALLS

Diagram shewing Discharge in Acre-Feet. from May 1909 to Feb. 1913
also
Effect of Lake Minnewanka Storage over low water periods

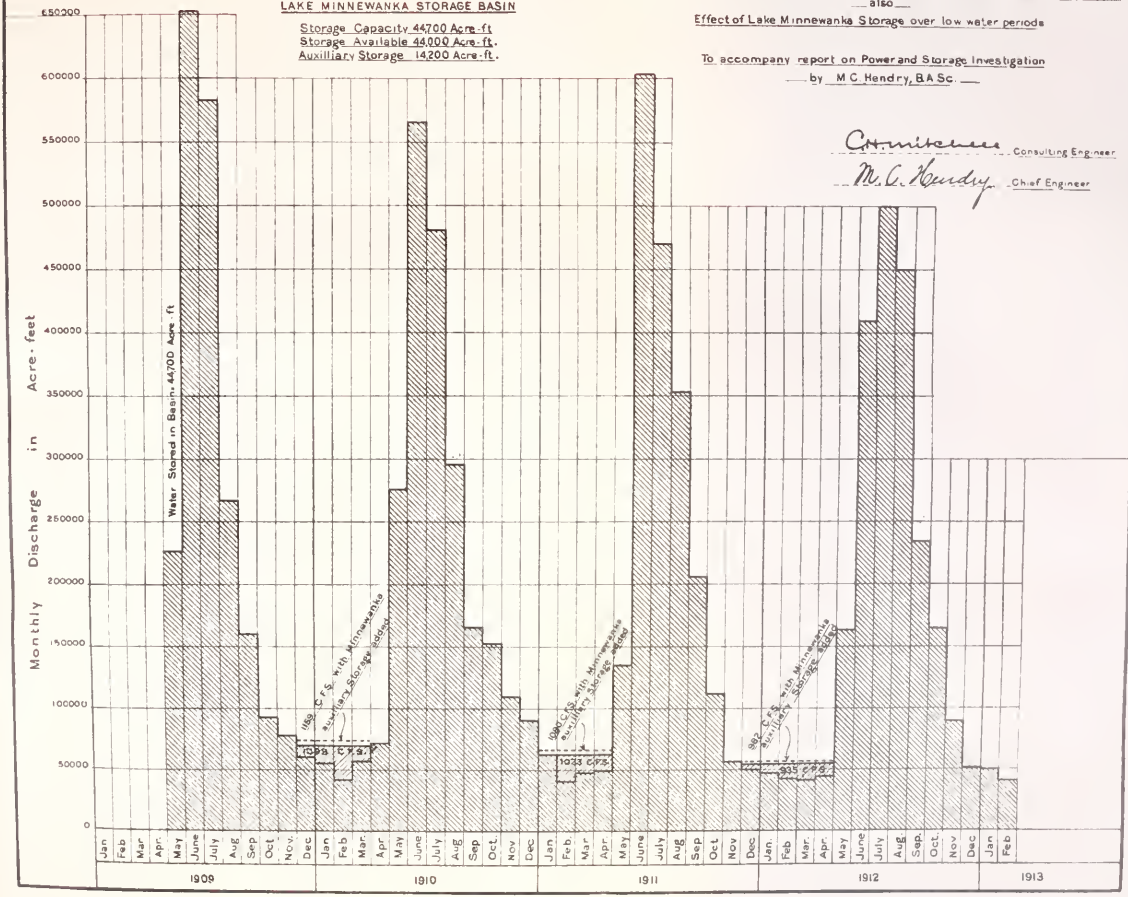
To accompany report on Power and Storage Investigation
by M C Hendry, B A Sc.

Consulting Engineer

M. C. Hendry Chief Engineer

LAKE MINNEWANKA STORAGE BASIN

Storage Capacity 44700 Acre-ft
Storage Available 44000 Acre-ft.
Auxilliary Storage 14200 Acre-ft.

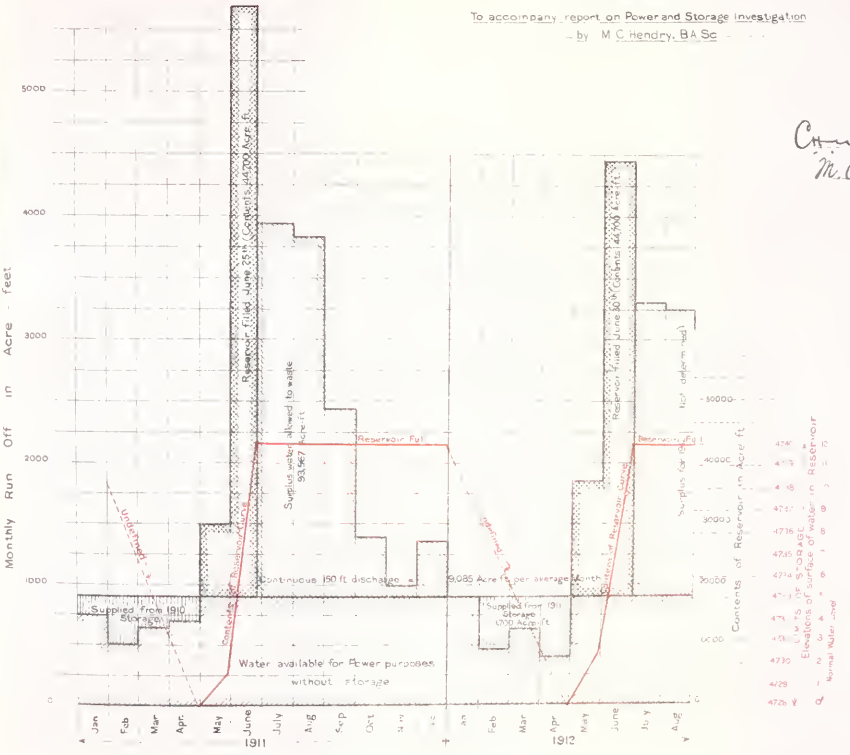


LAKE MINNEWANKA STORAGE

Diagram shewing Discharge in Acre-Feet, from Jan. 1911 to Aug. 1912
also
Process of Filling Basin, and providing
for a constant Discharge of 150 Sec-Ft.
with 12 ft of Storage

To accompany report on Power and Storage Investigation
by M C Hendry, B A Sc

C. Mitchell — Consulting Engineer
M. C. Hendry — Chief Engineer



Wall of Devil's Canyon, Centre line of Dam before Construction.

Photo by M. C. Hendry.

on Devil's creek by the Irrigation branch in June, 1910, and from that date until May 31, 1912, continuous records were kept. Isolated meterings were made of the Cascade during the first part of this period; then in August, 1911, a gauging station was established upon it below the mouth of Devil's creek, from which records are available up to June, 1912. All these records are included in the report.

Diagrams.

From the available records, two curves (see diagrams, Plates Nos. 10 and 13) have been prepared by Mr. J. T. Johnston for the department, and these, supplemented by others, are here made use of. Owing to the lack of continuity in the data for the Cascade during 1910, that period is not included. Diagram, Plate No. 10, is compiled from the mean monthly discharges in sec.-feet for the period January, 1911, to January, 1913, and shows the relation of the reserved flow of 150 c.f.s. to the monthly discharges. Tables have also been compiled in connection with these diagrams. Table No. 11 compiled from the available data shows when the basin could be filled.

In 1911, allowing for a continuous flow of 150 sec.-feet, and commencing to fill the reservoir on May 1, providing for a storage of 44,000 acre-feet, the basin would have been filled by June 24. The surplus run-off (over and above the 150 c.f.s. provided for) up to December 31, would amount to 84,530 acre-feet. During the period, January 1 to May 1, the storage is discharged; no attempt is made to show how this would be done, as it depends upon the stage of the Bow river and the necessity of storage.

In 1912, assuming that the filling of the reservoir was started May 1, 1912, the total amount of 44,000 acre-feet would have been in the basin by July 1, allowing, as before, for a continuous flow of 150 sec.-feet; the surplus discharge that could have been used as storage would amount to 47,700 acre-feet up to September 1, 1912.

From the above it will be seen that there is evidently ample discharge from the lake and Cascade river to fill the basin. Owing to the influx of tourists after July 1, the mere fact of filling is not the sole requisite, and it is desirable that the basin be filled as early after June 15 as possible, so that unsightly flats may not be exposed to view; it is certain, however, that the basin can be so nearly filled by July 1 of any year that no apprehension need be occasioned that the lake will suffer from the scenic standpoint.

TABLE No. 11.

LAKE MINNEWANKA STORAGE, RECORD OF FLOW AND STORAGE WITH 150 SECOND-FEET DRAW-OFF. CAPACITY, 44,700 ACRE-FEET.

Month.	Mean Flow.	Allowing 150 Second-feet Continuous Flow.					Remarks.
		Flow past Power-house.	To fill reservoir.		Surplus Flow.	Surplus Flow in acre-feet.	
			Flow.	Quantity in acre-feet.			
1911.							
January	122	...	...	...	...	...	
February	101	...	...	...	...	...	
March	104	...	...	...	...	...	
April	118	...	...	...	...	...	Started filling May 1st.
May	245	150	95	5,841·3	...	...	
June 25	956	150	806	38,859	...	...	Reservoir filled June 25.
				44,700·3			
June 25–30	956	956	...	...	806	9,101	
July	642	642	...	...	492	30,252	
August	624	624	...	...	474	29,144	
September	411	411	...	...	261	15,530	
October	226	226	...	...	76	4,673	
November	166	166	...	...	16	952	
December	221	221	...	...	71	4,366	
						94,018	
1912.							
January	149	150	...	...	...	...	
February	85	150	...	...	...	...	
March	102	150	...	...	...	...	
April	67	150	...	...	...	...	
May	301	150	151	9,285	...	...	Started filling May 1st.
June 30	748	150	598	35,583	...	...	Reservoir filled June 30th.
				44,868			
July	538	150	...	...	388	23,855	
August	538	150	...	...	388	23,855	

(NOTE.—The actual capacity of the basin is 44,700 acre-feet; of this amount 44,000 acre-feet has been granted as storage, and it is upon this basis that the following tables Nos. 11, 12 and 13 are worked out.)

STORAGE CAPACITY.

The limiting levels for storage created on lake Minnewanka were fixed from the surveys made. The existing normal level of the lake was elevation 4,728.00, though this was not the natural level of the lake, which was some 4 feet lower, but had been raised to the existing elevation by a small wooden dam placed in Devil's creek about one-quarter of a mile below the outlet of the lake. (See reproduction, page 72.) This dam was still in place, and during the winter 1911-12, it was cut and a stoplog opening made; stoplogs were put in place, but could be removed with little labour.

The upper limiting level of the lake was placed at 4,740; 12 feet above the existing normal level, giving 16 feet between former normal lake level and the proposed top elevation.

The amount of storage available between elevations 4,728 and 4,740 is 44,700 acre-feet, an excess of 700 acre-feet over the amount of storage granted.

A depth of 0.2 feet in the lake would account for the 700 acre-feet, and as this difference in elevation may easily occur between the lake and the dam, due to storing or drawing down, the limiting elevations were fixed as above. (The effect of this amount of storage upon the Bow river at Horseshoe falls may be seen by a reference to diagram, Plate No. 9.) Between elevation 4,728 and 4,724, 14,200 acre-feet of storage is available, and this may be made use of in connection with a contemplated Government power proposition on the Cascade river.

Construction.

An agreement was entered into between the Water Power Branch and the Calgary Power Company, and the construction of a dam in Devil's canyon to provide for the impounding of water in lake Minnewanka commenced early in the spring of 1912. Plans were submitted by the Company, and after examination by Mr. C. H. Mitchell, Consulting Engineer to the Water Power Branch, certain modifications and additions were required.

Dam.

The plans submitted provided for a concrete dam to be placed at the entrance of the canyon. The dam consisted of a spillway section with four spillways and a sluice-way for unwatering, and a deck to act as a bridge, spanning the canyon, and also to be used to carry the winch for operating the stoplogs in the sluice-ways; provision was also made for a fishway, if required. The changes recommended by Mr. Mitchell were made partly from a study of the plans, and partly as a result of an inspection of the conditions existing in the ground, these are embodied in the accompanying plans and are as follows: In place of the deep sluice-way on the left of the dam, a penstock opening was provided with the necessary racks, intake piers, stoplog openings, etc. A steel thimble to form the intake end of a penstock 5 feet in diameter was placed, this was 12 feet in length, 5 feet diameter at the lower end, and flared to an oval-shaped opening, 5 feet 8 inches by 8 feet 0 inches, so as to give the necessary easy entrance; I-beams were also provided for holding racks. Certain precautions were also recommended and carried out in building.

The construction of the dam was an interesting piece of work. The place is very restricted, and in addition to that, it was necessary to take care of the discharge of lake Minnewanka and Cascade river during construction. To do this, a cofferdam was placed at the entrance to the canyon. A concrete block (see plan No. 17) was first placed at one side of the river bed, the cofferdam extending from the block to the opposite canyon wall; behind this a concrete wall was placed and a flume built with the concrete block as the controlling works, the downstream end being kept at an elevation sufficient to allow the river bottom under the flume to be cleared. The flume was built to provide for a discharge of 300 c.f.s. with a depth of 18 inches (see reproduction page 79). Excavation was carried on behind the cofferdam, and below the flume; the conditions revealed were interesting; the bottom was covered with heavy gravel and boulders to a depth of 8 or 10 feet, and the bedrock was worn into numerous pot holes (see reproductions, page 79). The section containing the sluice and valve was placed first, the flume was then removed and the water diverted through the sluice-way, the other side then built to the level of the first section; after which the whole was carried to the top elevation at the same time.

Large seams existed in the wall rock (see reproduction, page 75). Leakage through these was provided against by facing up with concrete and allowing free discharge on the downstream side; possibility of erosion was in-

sured against by the same method (see plan No. 17). The Cascade is a turbulent stream and carries much silt and gravel in high water; to prevent any possibility of the valve clogging, the concrete cofferdam was left in, and a wall from the cofferdam to the entrance of the sluice-way was built, thus any material carried by the water would be prevented from passing into the sluice-way.

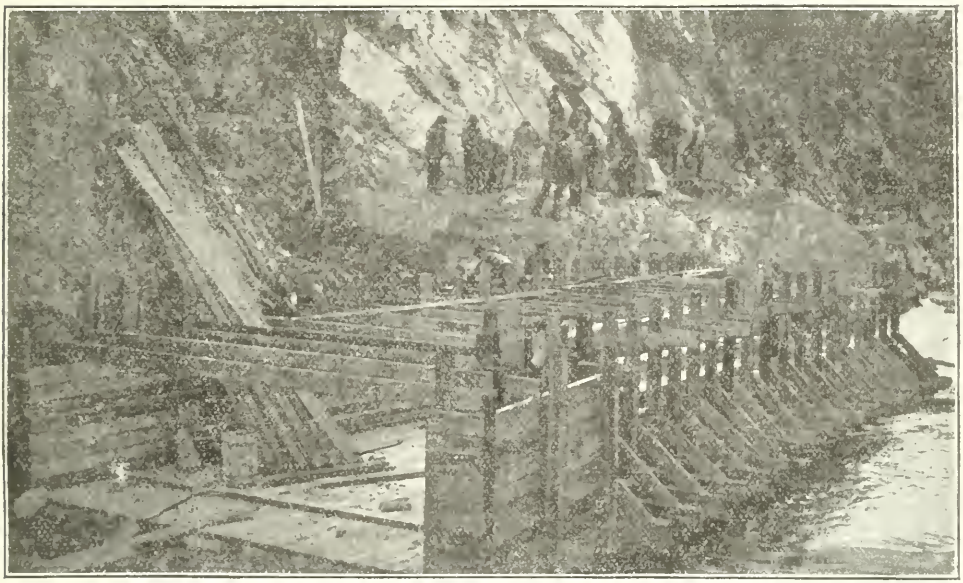


Photo by M. C. Hendry.

Unwatering Flume.

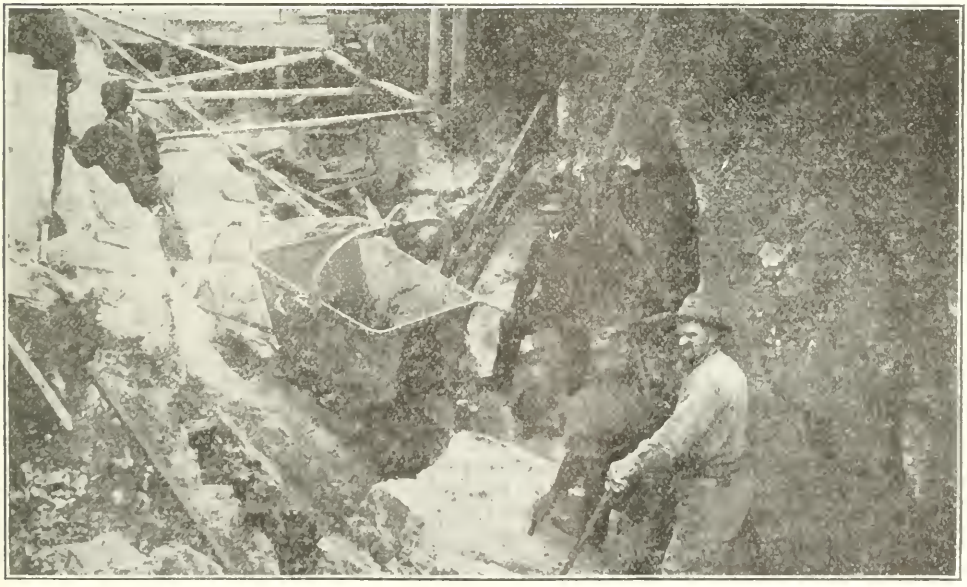


Photo by M. C. Hendry.

Potholes in Canyon Bottom.

The dam was completed in May, 1912. The construction was carried on by the Foundation Company of Montreal under contract with the Calgary Power Company, and both companies are to be congratulated for the expedition with which the work was carried out and the general appearance of the structure on completion.

Clearing Basin.

Simultaneous with the construction of the dam, the work of clearing the margins of the lake and the area within the flood line at the lower end of the lake, and on the Cascade river was carried on; also such additional work as, removal of buildings, clearing up the new townsite, building necessary road diversions and improving the old road, changing the telephone line and building a new wharf with slips for the boats on the lake. The clearing amounted to nearly 600 acres, a great proportion of the flooded area being very densely wooded, and as the department required careful clearing and low cutting of the stumps, considerable work was involved.

A resurvey of the area devoted to summer cottages, and a change in the layout was made, and some additional lots surveyed; the plot was then cleared up, one or two of the streets were graded and the whole was left in good shape.

Bridge.

The road diversion necessitated a new bridge over Devil's creek; the new bridge was considerably longer than the old one and was built entirely of timber, with the exception of the concrete foundation put in to carry the two main cribs. In order that the west end of the lake and the flooded portion of the Cascade river might be used for small pleasure crafts, the under side of the stringers of the bridge were placed 4 feet above high-water level, giving ample room for boats to pass under.

The improvements made, such as new wharf, roads, bridge, etc., are illustrated in the accompanying illustrations. The work of creating storage on lake Minnewanka was carried out very expeditiously; work was commenced in March, 1912, a dam built in the canyon, over 600 acres of clearing done, a road diversion of 1 mile made and regraded, a new bridge built, a new townsite surveyed, and buildings moved out of the flooded area and in some cases rebuilt, 1 mile of telephone line rebuilt, a new wharf built and two slips provided, together with a marine railway for each, all of which was completed by the 1st of July. The storage of water was commenced on June 1, 1912, and the level was raised to 4,740 by August 12; the storage could have been completed much earlier, but was held back by the progress of the clearing, so that flooding did not begin until the date given.

Power in Connection with Storage.

Lake Minnewanka is 8 miles by road from the well-known mountain resort, Banff, the visitors to which are rapidly increasing in numbers. This town is the principal place in the Rocky Mountains park, and from here many camping parties enter the mountains. As a place where people may spend the summer either at the hotels or in summer cottages, it offers many attractions, and in passing it might be mentioned that three times as many people visited Banff during the summer of 1911 as visited the famed Yellowstone park. With this increased population, the necessity of power for lighting streets and houses has also increased; at present the power is supplied from the Bankhead mines, which is 6 miles from Banff, on the road to Minnewanka; no franchise has been given, the street lighting being done by yearly contract.

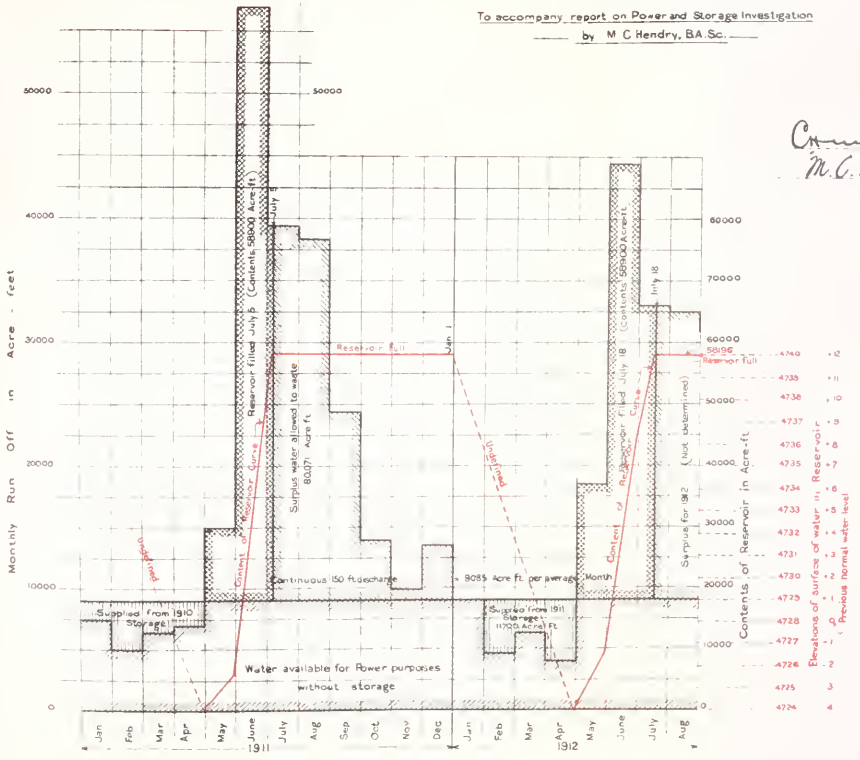
LAKE MINNEWANKA STORAGE

Diagram shewing Discharge in Acre-Feet, from Jan 1911 to Aug. 1912
—also—
Process of Filling Basin, and providing
for a constant Discharge of 150 Sec- Ft.
with 16 ft. of Storage

To accompany report on Power and Storage Investigation
by M C Hendry, B.A.Sc.

Consulting Engineer

Chief Engineer


Monthly Run Off in Acre - feet
Contents of Reservoir in Acre-ft.
Elevations of surface of water in Reservoir
Previous normal water level
Reservoir filled July 8 (Contents 58800 Acre-ft)
Reservoir filled July 18 (Contents 58800 Acre-ft)
Reservoir Full
Surplus water allowed to waste 80,071 Acre ft.
Surplus for 1912 (Not determined)
Continuous 150 ft discharge
8085 Acre ft. per average Month
Supplied from 1910 Storage 11700 Acre Ft.
Supplied from 1911 Storage 11700 Acre Ft.
Water available for Power purposes without storage
Content of Reservoir Curve
Depleted
Jan 1
July 8
July 18
1911
1912
Jan Feb Mar Apr May June July Aug Sep Oct Nov Dec Jan Feb Mar Apr May June July Aug

Compiled from data on hand to date by

J T Johnston
Hydraulic Engineer

The park and town are under the Dominion Government control through the Parks Branch, Department of the Interior. Under the conditions existing, it was considered that a power plant operated by the park authorities would be a good thing; the feasibility of producing power in connection with the storage in lake Minnewanka was looked into, and the conclusion was reached that such was possible. Provision for the utilization of the storage dam as head-works of the power scheme was therefore secured, and the plans show the method of making use of the storage dam as an intake for the plant.

Utilization of Flow for Power from Extra Storage.

In connection with the storage of water in lake Minnewanka, when the agreement was made with the Calgary Power Company, granting them the right to store water in the lake, a clause was inserted whereby the department reserved the right to a continuous flow of 150 second-feet, to be used for development of power or other purposes; in addition, the company was required to so modify the design of the structure as to permit of it being made use of as head-works for a power plant, the construction of which the department had in mind. The discharge data in this connection is interesting, and some of the diagrams included are to illustrate the utilization of the water discharged from storage for that purpose. In making use of the water in such a manner, a continuous flow is necessary, and in making provision for 150 c.f.s. continuous flow it was not the intention to work a hardship to the company, as there might be occasions when it would be advantageous to conserve the storage as much as possible. Having in mind this point, an investigation was made as to the effect of the department making use of 4 feet extra storage, not by raising the lake an extra 4 feet, but by drawing it down to a lower level; by this method, 14,200 acre-feet could be made available. The diagram shown on Plate No. 11, together with Table No. 12, compiled by Mr. Johnston, was plotted with this object in view; these are self-explanatory. The basin, as in the other case, is assumed empty May 1, 1911, but at the lower elevation 4 feet below normal lake level; deducting the 150 c.f.s. reserved from the mean monthly flow, it is found that the reservoir could have been filled by July 1, 1911, or 58,900 acre-feet could be stored. From then until December 31, 1911, 80,071 acre-feet would be wasted, over and above the 150 c.f.s. discharge. During the interval of low water, *i.e.*, with less than 150 c.f.s. discharge, from January 1 to May 1, 11,699 acre-feet would be required from storage, to make up the flow to 150 c.f.s., or less than the extra storage secured by lowering the basin 4 feet below normal lake level. So that, had it been necessary to utilize the storage at other than the time it was required by the Calgary Power Company, it would still be possible to pay them back out of the department's reserve. The method of emptying the basin is indeterminate, but filling is again commenced (at the low level) on May 1, 1912, from which date to August 30, the limit of the data, some 33,850 acre-feet, was wasted, after allowing for the 150 c.f.s. discharge called for. In this scheme, as in the other, no detrimental effects are to be expected from the slight delay in filling the basin, as by July 1 only the top rim of the lake would be exposed.

It will be noted in examining the tables that the total storage capacity of the basin is given as 44,700 acre-feet for the 12-foot storage and 58,900 feet for the 16-foot storage, and that only a run-off of 44,000 acre-feet has been granted; this is to provide for some leeway in regulation.

Utilization of Flow of 200 Second-feet with Extra Storage.

The scheme was then extended a little further, and diagrams and a table prepared on the assumption of 200 c.f.s. continuous run-off. The diagram, Plate

No. 12 and Table No. 13 cover this case. Beginning at the same time, and assuming as before the lake level 4 feet below normal level, the reservoir could be filled by July 12; 58,180 acre-feet being stored from then until October 31,

TABLE NO. 12.

LAKE MINNEWANKA STORAGE. RECORD OF FLOW AND STORAGE WITH A 150 SECOND-FEET DRAW-OFF. CAPACITY 58,900 ACRE-FEET.

Month.	Mean flow c.f.s.	Flow past Power-station.	Allowing 150 Second-feet continuous flow.						Remarks.
			To fill reservoir.		Surplus flow, c.f.s.	Surplus flow, in ac.-ft.	Deficit flow, c.f.s.	Deficit flow, acre-feet.	
			Flow c.f.s.	Flow ac.-ft.					
1911.									
January	122								
February	101								
March	104								
April	118								
May	245	150	95	5,850					Started filling May 1.
June	956	150	806	47,980					
July 1–5	642	150	492	4,870					
				58,700					
July 6–31	642	542			492	25,370			Reservoir filled
August	624	624			474	29,160			July 5.
September	411	411			261	15,550			
October	226	226			76	4,672			
November	166	166			16	953			
December	221	221			71	4,366			
						80,071			
1912.									
January	149	150					1	60	
February	85	150					65	3,743	
March	102	150					48	2,953	
April	67	150					83	4,943	
								11,699	
May	301	150	151	9,285					Started filling May 1.
June	748	150	598	35,600					
July 1–18	538	150	388	13,850					Reservoir filled July 18.
				58,735					
July 19–31	538	538			388	10,000			
August	538	538			388	23,850			

55,990 acre-feet would be wasted, after providing for a continuous flow of 200 c.f.s. Through the low-water period, 26,130 acre-feet would have to be released from storage to ensure a continuous flow of 200 second-feet. While this is in excess of the amount of storage in the lower 4 feet, it is reasonable to suppose that part would be provided by water released for the Calgary Power Company's own purposes. Beginning to store on May 1, 1912, that basin would be filled by July 29. This is assurance that, should the department find it necessary to increase the output of the contemplated plant at any future time, a flow of 200 c.f.s. can be obtained by making use of the additional storage. Further, the possibility of any difficulty arising from the regulation of discharge from storage for power purposes in the Bow river is practically eliminated, the department being in a position to offer return for any overdraft on the storage

LAKE MINNEWANKA STORAGE

Diagram shewing Discharge in Acre-Feet, from Jan. 1911 to Aug. 1912

— also —

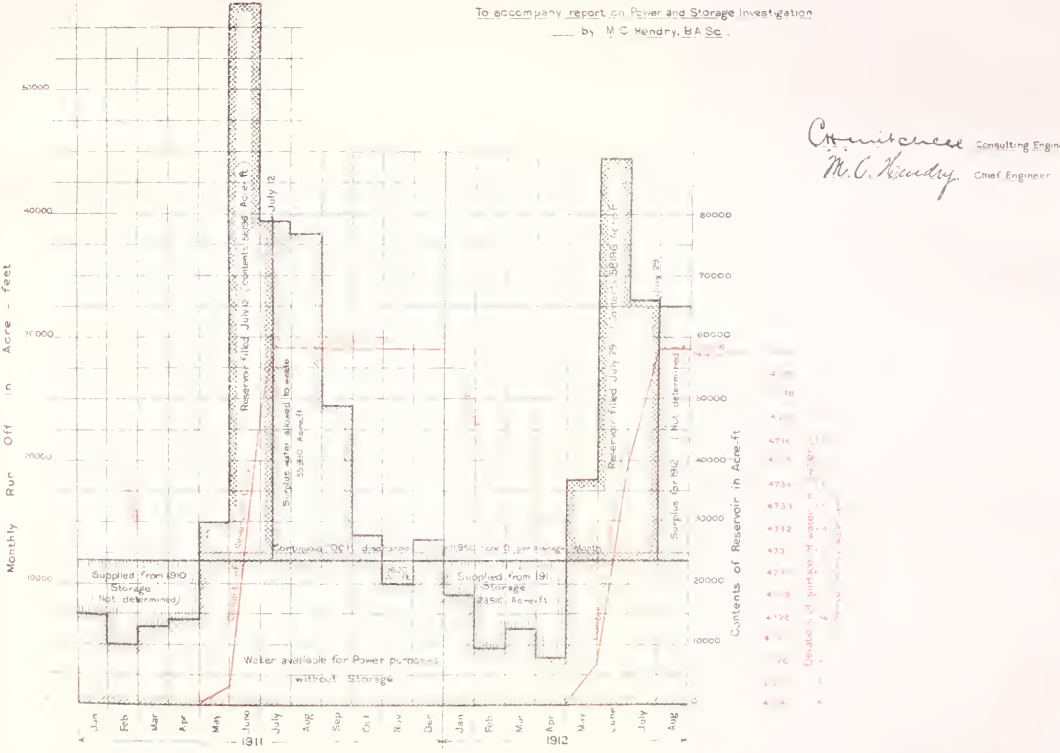
Process of Filling Basin, and providing for a constant Discharge of 200 Sec-Ft. with 15 ft. of Storage

To accompany report on Power and Storage Investigation

— by M C Hendry, B A Sc.

Consulting Engineer

M. C. Hendry. Chief Engineer


Monthly Run Off in Acre - feet
Contents of Reservoir in Acre-ft.
Reservoir filled July 12 (contents 58246 Acre ft.)
Surplus water allowed to waste 55340 Acre-ft
Continuous 200 ft. discharge
11964 cons ft. per average Month
Reservoir filled July 29 (contents 58246 Acre ft.)
Surplus for 1912 (Not determined)
Supplied from 1910 Storage (Not determined)
Supplied from 191 Storage 23510 Acre-ft
Water available for Power purposes without Storage
Jan Feb Mar Apr May June July Aug Sep Oct Nov Dec
1911
Jan Feb Mar Apr May June July Aug
1912

Compiled from data on hand to date by

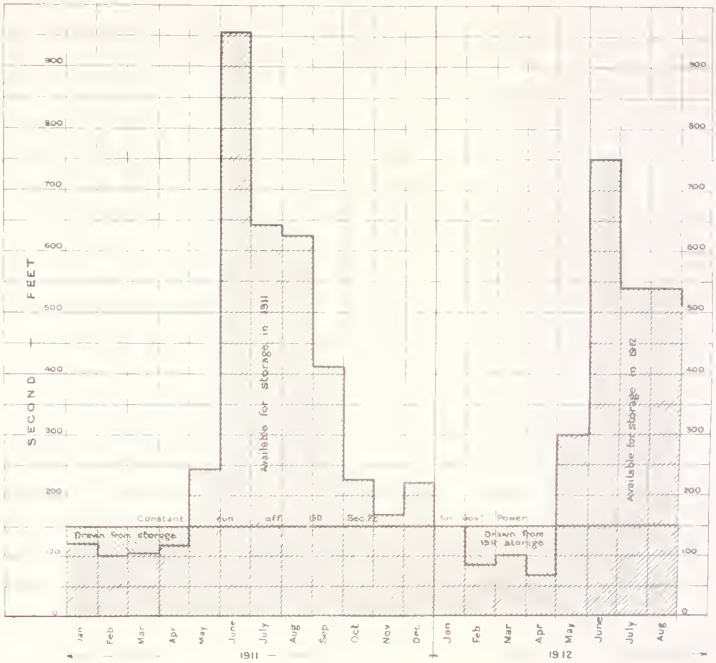
J T Johnston
Hydraulic Engineer

LAKE MINNEWANKA STORAGE

Hydrograph of Mean Monthly Flow from January 1911 to August 1912
showing
Conditions imposed by a constant Run Off of 150 Sec Ft

To accompany report on Power and Storage Investigation
By M.G. Hendry, B.A.Sc.

C. Mitchell Consulting Engineer
M.G. Hendry Chief Engineer



basin at the beginning of the low-water season, and in this way each water user may aid the other, and the discharge may be so adjusted as to be of the greatest mutual benefit.

The storage of 44,000 acre-feet in lake Minnewanka provides for a continuous flow for five months of 150 c.f.s. (see diagram, Plate No. 13), nearly all of this will become available for use in the power section of the Bow river; any loss due to evaporation may be neglected, for after the basin is once filled there is more than enough flow to keep it full, and when the lake freezes, this loss is practically stopped.

Under the general head of evaporation, all losses are included; that due to ice is the largest and the most difficult of determination. The storage in the lake, which is held in the form of ice, is not all available until the latter end of April, or even later, though doubtless the greater part of it will become available before the general flood takes place on the river.

TABLE No. 13.

LAKE MINNEWANKA STORAGE. RECORDS OF FLOW AND STORAGE WITH A 200 SECOND-FEET DRAW-OFF CAPACITY 58,900 ACRE-FEET.

Month.	Mean Flow c.f.s.	Allowing 200 c.f.s. Continuous Flow.						Remarks.
		Flow past Power-station.	To fill reservoir.		Surplus flow in c.f.s.	Surplus flow in ac.-ft.	Deficit flow c.f.s.	Deficit flow acre-feet.	
			Flow c.f.s.	Quantity in ac.-feet.					
1911.									
January	122								
February	101								
March	104								
April	118								
May	245	200	45	2,680					Started filling May 1.
June	956	200	756	44,970					
July 1–12	642	200	442	10,530					Reservoir filled July 12.
				58,180					
July 13–31	642	642			442	15,780			
August	624	624			424	26,050			
September	411	411			211	12,560			
October	226	226			26	1,600			
November	166	200					44	2,620	
December	221	221			21	1,290			
						57,280			
1912.									
January	149	200					51	3,180	
February	85	200					115	6,390	
March	102	200					98	6,030	
April	67	200					133	7,910	
								26,130	
May	301	200	101	6,130					Started filling May 1.
June	748	200	548	32,630					
July 1–29	538	200	338	19,450					Reservoir filled July 29.
				58,210					
July 30–31	538	538			338	1,340			
August	538				338	20,780			

INFLUENCE OF WINTER CONDITIONS ON DISCHARGE FROM STORAGE.

The dissipation of storage through the formation of ice, and the extent of its influence has required considerable attention. During the winter 1912-1913, a study was made of the situation. The release of water from lake Minnewanka the last winter was not attended with unmixed success from the

power standpoint. One reason for this was the distance between the storage basin and the point of utilization, approximately twenty-four hours being required for water from the lake to reach the power station, thus close regulation was prevented; a scheme is now on foot to remedy this. Another adverse influence was the formation of ice in the bed of the Cascade river, and overflow of the valley. This condition existed to a very marked degree between Bankhead and the junction with the Bow, for as is the case with all rapidly flowing open streams during extreme cold weather, large quantities of frazil ice was formed in the Cascade; this ice formed blockades, dammed back the river, flooding the flats where the water was turned into ice. Nearly the whole of the section referred to was covered with a sheet of ice, extending across the valley. In places this ice field was two or three hundred yards across and of a depth of 3 feet. Where the valley was more confined, the sheet was not so wide, but was as much as 7 feet thick (see reproductions, pages 19 and 25). No doubt, the formation of anchor ice had something to do with the flooding, but frazil appears to have been the greatest cause, coupled with other conditions.

From a study of the discharge curve of lake Minnewanka during the winter, together with the temperature curve for the same period, the following conclusions have been drawn. During the periods of comparatively mild weather, little water was flowing in the river, the channel became very much restricted and clogged with the ice margins and hard snow. Directly a cold snap came, a considerable quantity of water was released, frazil formed, and blocked up the restricted channels, the flats, overflowed and froze, causing ice fields.

From an examination of the other streams in the vicinity, this explanation is apparently confirmed, because little evidence of overflow and ice formation existed at the end of the season. The normal flow apparently did not have the same effect as that of a regulated stream where little water flowed during normal, and large quantities during severe weather.

It is expected, in view of this, that with a plant in Cascade below the dam, and a consequent continuous flow of considerable volume, little difficulty will be experienced from ice after the plant is installed.

The loss of water due to ice formation in the stream is rather a loss of regulation than actual loss of water, as nearly all eventually becomes available during the latter end of the low-water period, the ice in the streams disappearing long before the high-water period.

SPRAY LAKE AND RIVER.

General.

The Spray river, one of the largest tributaries of the Bow west of Calgary, joins that stream in the Rocky Mountains park, at Banff, just below the Spray falls on the Bow. Flowing from the south, it enters the Bow valley between mount Rundle and Sulphur mountain; it is between 40 and 50 miles long from source to mouth, and has a drainage area of 310 square miles. About 8 miles above the mouth, the river branches, one branch, the east and smallest, flows from the valley between mount Rundle and Goat mountain.

The west branch comes down the valley on the other side of the Goat range. The fall in the river is fairly regular, about 40 feet per mile, the valley is very narrow and the banks are very high and precipitous. From the junction upstream for about 17 miles, this branch flows through a narrow valley between the Goat range and the range to the west, and the total drop in the distance is 750 feet. In this stretch there are very few creeks of any size coming in; the possibility of power has not been investigated, but it is quite possible that a limited amount, such as that to be developed on the Cascade in connection with the storage at lake Minnewanka, might be developed.

At the end of this stretch of the river, it breaks up into three branches, the main branch from the south, one which forms the outlet of the Spray lakes and Hogarth creek. (See reproduction, page 95).

The principal branch is from the south. About 5 miles above the lakes it divides into two branches, one to the east heading on the main continental divide in a small lake, and the other from the west having its source in a small lake under mount Assiniboine. The fall in these two branches is considerable, but no records are available as to the slope.

Hogarth creek is rather small, and flows between the Spray and Kananaskis ranges, heading on the divide between the Spray and Kananaskis rivers.

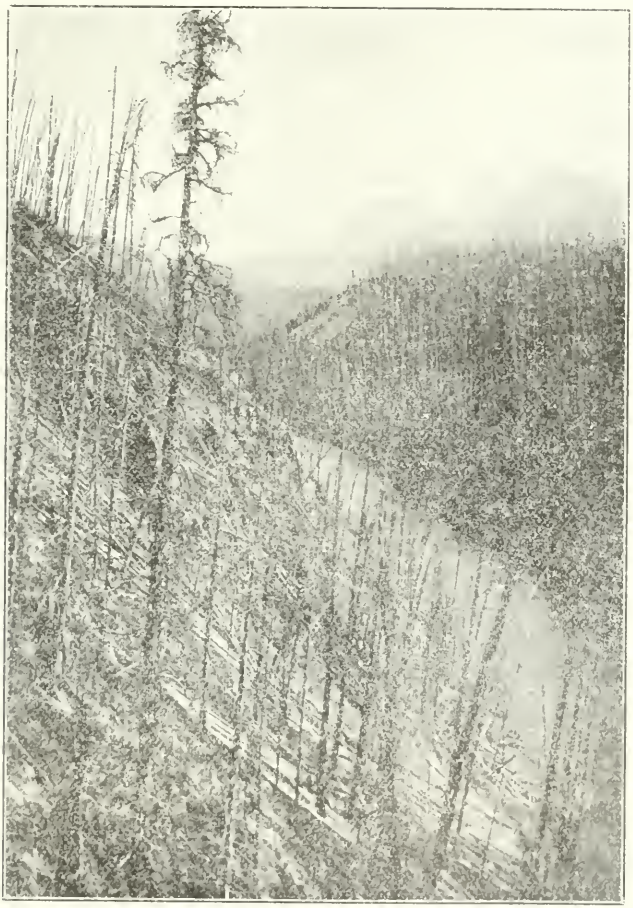


Photo by K. H. Smith.

Spray River Canyon (Looking Upstream).

Lakes.

The Spray lakes, three in number, lie to the north of the river. They are connected with it by a stream about half-a-mile in length, which enters just below the mouth of Hogarth creek. The lakes lie in the main valley between high mountains, and are connected by small streams. The lower and largest lake is 301 acres in extent, and lies at an elevation of over 5,000 feet, given on the maps as 5,396, but assumed for purposes of survey at 5,200 feet. The

Second lake, which is 37 feet higher than the first, is 143 acres in extent, and the third has an area of 17 acres, and is 3 feet higher than the second lake. The total area of the lakes is 461 acres.

Photo by K. H. Smith.

Spray River Canyon (looking down stream).

Reconnaisance.

A reconnaisance was made of these lakes in July, 1911, but it was not until July, 1912, that any work was done there. At that time a small party was put in the field, consisting of an engineer and two assistants, a cook, and a packer with a pack train. The surrounding country, while wooded to a considerable extent, is fairly open, the timber being generally dry, and standing, permitting the use of a plane table, by which method the whole valley was developed.

The reconnaissance revealed the fact that the general topography of the country surrounding the lakes lent itself to the creation of storage. The main branch of the Spray at this point comes from the south, is joined by Hogarth creek from the east and the outlet of the lakes from the north; and at the junction of these creeks a wide valley is formed. About one-quarter-of-a-mile from the lower lake, just below the junction of the branch from the lakes and the main stream, the river leaves the valley through a narrow canyon, the walls of which

are of rock formation, covered, to a greater or less extent, by soil and detritus, and are wooded. These walls rise on a slope of not less than 60°, to a height of at least 300 feet, the rock outcrops being nearly perpendicular for a great portion of their height. (See reproductions, pages 85 and 86). This canyon extends downstream about a mile, the stream falling rapidly; the width at the water level is from 60 to 150 feet, and at an elevation of 150 feet above the water, between 400 and 450 feet.

There is evidence of rock above this point, and on the south side an outcrop appears at an elevation of over 160 feet above water level, and extends up and down stream as far as was examined.

The rock on the south is of limestone formation, and appears to dip towards the south, and is overlaid to a considerable depth with a glacier deposit. On the north side the rock resembles a sandstone formation, the valley having been formed apparently in the fault between the two formations as on the north side the dip is practically vertical; the rock rises higher, and is overlaid to a greater depth than on the south side, the outcrop appearing at least 200 feet above the level of the water.

The conclusion reached from the reconnaissance was that, by placing a dam in this canyon, as near the mouth as practicable, considerable storage could be developed in the basin behind.

Survey.

The survey made of the basin in the summer of 1912 was made with the object of verifying the conclusions reached in reconnaissance. The work was done as rapidly as possible by plane table, and with a degree of accuracy commensurate with the object in view. Special attention was paid to the canyon, which was contoured with care, with the object of locating several dam sites, all rock outcrops, etc., were located in order that fairly close estimates might be made of the probable cost of control structures.

A careful study was made of the canyon at the time the survey was commenced, and it was decided to make the 5,300 feet contour (lake level, 5,200), the limiting elevation, as far as the structure in the canyon was concerned, though it was not certain at the time that this would not lead to difficulties in other parts of the valley. With this in mind, the contours were developed by the plane table, particular attention being given to the 5,250, 5,275 and 5,300 contours, though sufficient information was taken to develop the intermediate ones at 10 foot intervals.

The method pursued was to run traverses with the plane table, making use of two rod men, sometimes the packer was pressed into service. Vertical angles were read.

No attempt was made to follow out a contour by horizontal shots, but by controlling all the changes in the ground, and sketching, on the ground, the country was developed. Frequent checks were made to eliminate errors. When the sheets were finally assembled, it was found that the traverses closed well within the permissible error for such work, and frequent checking for elevation exhibited the same condition.

In referring to this basin it seems well to draw attention to this method of survey. Where the country is of such a nature that control of the ground may be had, there is no doubt that the plane table will give results quite accurate enough for preliminary work and if extra care is taken, results may be obtained upon which final estimates for the creation of storage may be based. The personnel of the party has been given before, but is repeated: one plane table man (engineer in charge), two rodmen, one handy man, one packer, and eight pack horses; on moving days the handyman acted as packer, and at odd times he

cooked and, when the party was working in timber, he acted as axeman. This party operated 30 miles from the base of supplies. Including the time of moving in and out, and actual work in the field, but excluding the cost of the work of the chief engineer, the work was done at a cost of 25 cents per acre, which, considering the value of the data secured, is very reasonable.

Area and Capacity.

The area contoured was roughly eight and one half miles long and three-quarters of a mile wide, giving inside the 5,300 contour, an area of 3,024 acres. This includes the three lakes in the valley and also the falls on the main branch of the river. The area inside the 5,275 contour is 2,429 acres; inside the 5,250 contour, the area is 1,755 acres; and inside the 5,220-foot contour the area is 729 acres. The quantity of water that could be stored below each contour is 171,129, 102,829, 49,986 and 11,880 acre-feet, respectively. A curve giving the contents of the basin at each foot of elevation shows that the storage capacity increases much more rapidly at the top of the reservoir than at the bottom. This curve, which is remarkably regular, emphasizes the advantage in storage capacity to be gained by raising the control works as high as possible. The assumption has been made in this report that the basin will have its upper level at 5,300, giving, in round numbers, a total storage of 171,000 acre-feet; of this amount, 160,000 acre-feet has been made the basis of all calculations, the remainder it is assumed being dissipated as evaporation or otherwise.

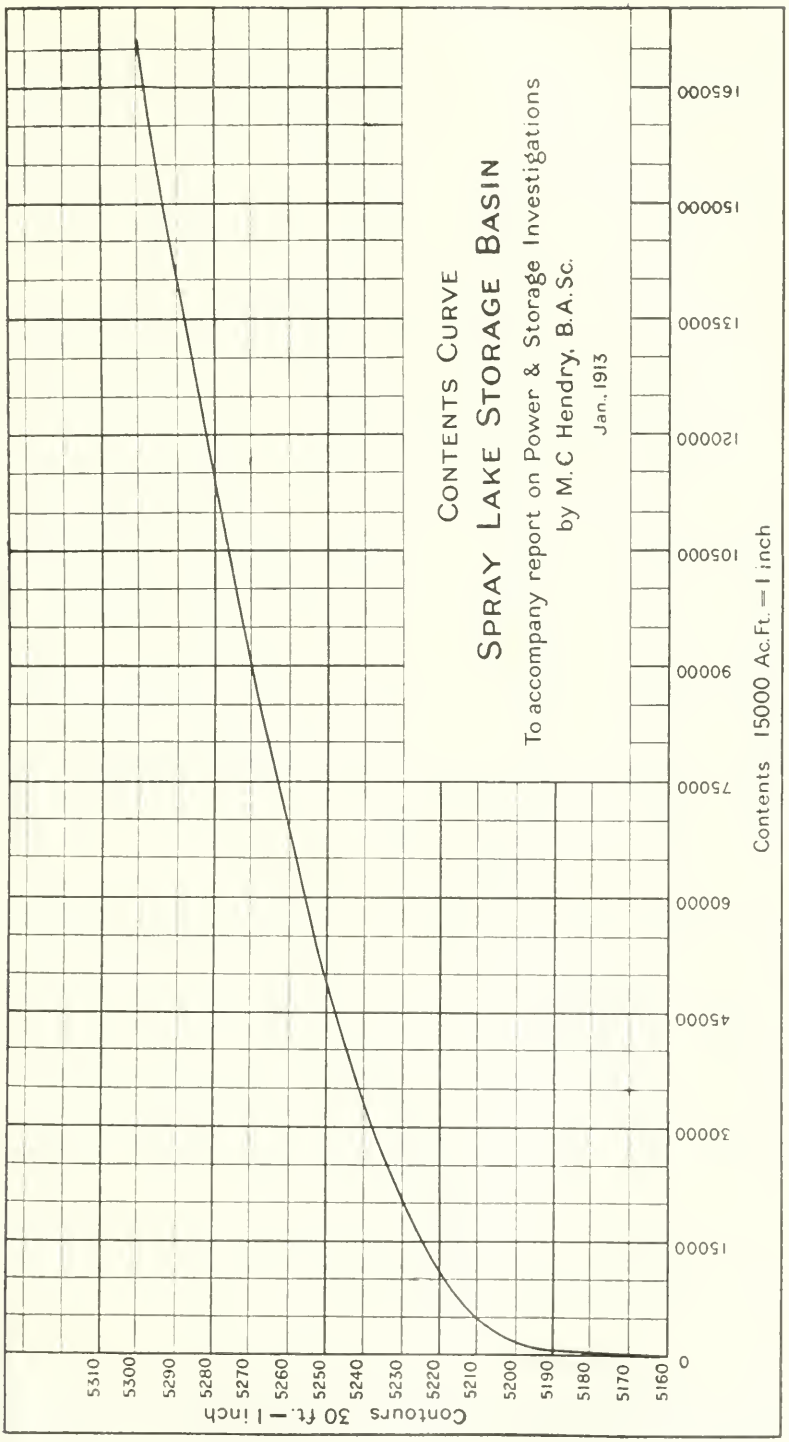
Discharge.

The gauging station on the Spray river, established in July, 1910, is located about 100 yards above the junction with the Bow, and in consequence the total discharge of the river is measured at that point. The records have been kept continuously since the establishment of the station, except for the month of November, 1910.

The only stream of consequence entering the Spray between the gauging station and the lakes, is the branch coming in at the end of Goat mountain; the discharge from this stream forms, however, but a small proportion of the total flow. The river heads for the most part in the glaciers and snow fields of the summit range, so that it is safe to assume that fully three-fifths of its discharge comes from above the entrance to the canyon, near the Spray lakes.

The results of the gaugings are tabulated and included with data of a like nature. A diagram (see plate No. 5) shows graphically the mean monthly discharge of the river over the period recorded. The discharge for the period, October 1, 1910, to October 1, 1911, excluding November, 1910, is 398,687 acre-feet; it may therefore be assumed that the discharge was well over 400,000 acre-feet for the whole period. The records do not extend over a sufficient period to enable any definite conclusions to be drawn, but the amount of water available for storage during the high-water period is estimated to be about twice that of the capacity of the storage basin.

From the discharge tables it will be seen that the minimum mean monthly discharge for the period recorded was 108 c.f.s. in March, 1912. The maximum mean monthly flow was 2,011 c.f.s. in June, 1911. The absolute minimum daily flow recorded was 75 c.f.s. on March 29, 1912, and the maximum daily discharge was 2,640, June 18, 1911. It is interesting to note that the period of minimum flow is apparently during the month of March rather than February, as in the other streams, but whether this will always hold true, and the reason for it, is not apparent.


CONTENTS CURVE
SPRAY LAKE STORAGE BASIN
To accompany report on Power & Storage Investigations
by M.C Hendry, B.A.Sc.
Jan., 1913
Contours 30 ft. — 1 inch
Contents 15000 Ac.Ft. = 1 inch
5310
5300
5290
5280
5270
5260
5250
5240
5230
5220
5210
5200
5190
5180
5170
5160
0
15000
30000
45000
60000
75000
90000
105000
120000
135000
150000
165000

Storage Operation.

Another diagram, Plate No. 14, has been prepared showing certain conditions of filling and emptying the storage basin based upon the recorded discharge of the river. In this connection it was necessary to make some assumptions as to the amount of water to be discharged during the operation of filling the reservoir, a discharge of 316 c.f.s. was therefore provided for, and the length of time necessary to fill the reservoir, and the amount of water wasted in excess of this flow was computed. It has been assumed that during the high-water period of 1910, the reservoir was filled; at the beginning of November, water was first released from storage and added to the mean monthly flow.

The distance of the basin from any point, other than one on the Spray river at which the water could be used for power purposes, is great, so any attempt at close regulation would be futile. It would only be possible to regulate upon the basis of a continuous flow of the Spray river itself, and it is upon this basis that the diagram for the stream has been compiled. Assuming that the intention is to augment the flow of the Bow river during the months in which low water occurs, would mean a flow from storage during six months of the year or from November 1 to May 1. With 160,000 acre-feet of available storage, a continuous flow of 446 c.f.s. could be maintained, adding the mean monthly flow of the river during these same months, and assuming that a continuous uniform flow is maintained, it would be possible to secure a discharge of 635 c.f.s.; making the same assumptions, and using the same reasoning, during the low-water period, 1911-12, 607 c.f.s. would be the continuous uniform flow for the period.

On the assumption that a flow of 316 c.f.s. is being provided during the storing period, and that filling the basin commences on May 1, it is found that for the year 1911 the basin could have been filled by July 23, 171,000 acre-feet being stored. From the time of filling to the time of commencing to discharge from storage, 64,937 acre-feet would be wasted in excess of the flow of 316 c.f.s. provided. From the year 1912, sufficient data are not to hand to compute the time of filling and the amount of waste.

Creation of Storage.

The best storage scheme in the Bow basin is undoubtedly that at the Spray lakes, though the proposition is not an easy one. The amount of additional water that could be made available would form a considerable percentage of the present low flow.

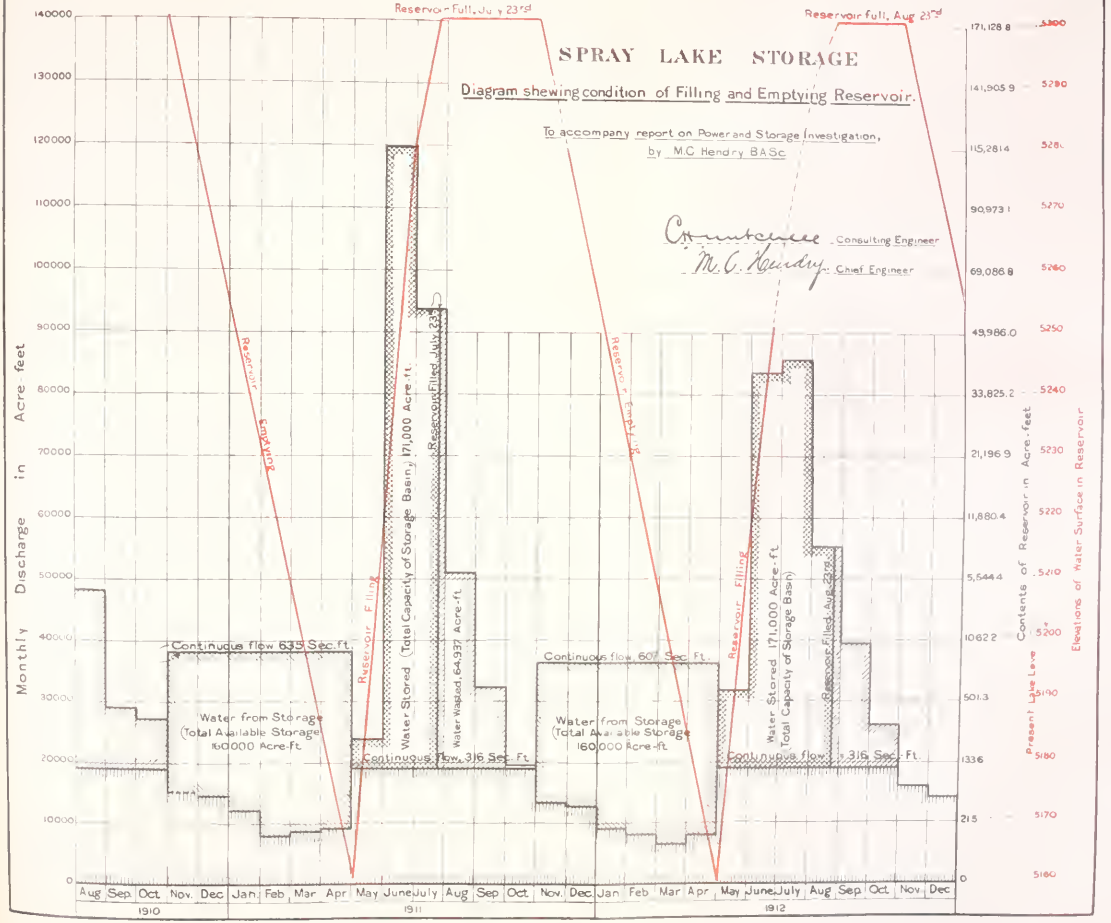
The size of the structure involved is great so that considerable care and thought will have to be exercised in the final design and construction; it is quite possible that if the proposition is undertaken, the general scheme as advanced now will require modification in many ways. With the information that is now available it is, however, considered that the creation of the amount of storage assumed is feasible, from both an engineering and economic stand-point.

Type of Structure.

The estimates for the cost of creating this storage basin are based upon the design of a hydraulic-fill type of dam.

Hydraulic-Fill Dams.

The hydraulic-fill type of dam belongs essentially to the western mining districts, especially California. It was in connection with the mining operations carried on there by means of sluices and hydraulic giants, or "monitors" that


SPRAY LAKE STORAGE
Diagram shewing condition of Filling and Emptying Reservoir.
To accompany report on Power and Storage Investigation,
by M.C Hendry B.A.Sc
Consulting Engineer
Chief Engineer
Monthly Discharge in Acre feet
Contents of Reservoir in Acre-feet
Elevations of Water Surface in Reservoir
Present Lake Level
Reservoir Full, July 23rd
Reservoir Full, Aug 23rd
Reservoir Emptying
Reservoir Filling
Reservoir Filled July 23rd
Reservoir Filled Aug 23rd
Water Stored (Total Capacity of Storage Basin) 171,000 Acre-ft.
Water Wasted, 64,937 Acre-ft.
Continuous flow 635 Sec. Ft.
Water from Storage (Total Available Storage 160,000 Acre-ft.
Continuous flow, 316 Sec. Ft.
Continuous flow 607 Sec. Ft.
Water from Storage (Total Available Storage 160,000 Acre-ft.
Continuous flow 316 Sec. Ft.
Water Stored 171,000 Acre-ft. (Total Capacity of Storage Basin)
Aug Sep Oct Nov Dec Jan Feb Mar Apr May June July Aug Sep Oct Nov Dec Jan Feb Mar Apr May June July Aug Sep Oct Nov Dec
1910
1911
1912

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the methods of excavating, transporting, and placing material to form a dam was originated, and it might be said that to the engineers of that section of the country belongs the credit of raising the method to its present high plane.

This type of dam is not confined to structures of low height, there being examples in existence of dams, built by this method, of heights varying from 77 feet to over 200 feet. Dams of this type are built of clay, gravel, rock and sand, which has been excavated and placed in position in the structure by means of water conveyed in pipes or sluices. Generally speaking, the material is excavated by the same agent, streams of water at a high velocity being directed against the material in its natural bed.

Mr. J. D. Schuyler, an authority on the subject, has, in a paper before the American Society of Civil Engineers, gone into the subject thoroughly. He has described in detail a number of dams of this type, amongst which are the following (Trans. Am. Soc. C.E., vol. LVIII):—

1. Crane Valley dam.
2. Terrace dam.
3. Lake Francis dam.
4. Tyler dam.
5. Como Lake dam.
6. Necaxa dam.

To this list may be added the Coquitlam dam in British Columbia, which is of particular interest, being a Canadian example.

Site.

The site of the proposed dam at Spray lakes, as has been mentioned before, lies in a narrow canyon near the outlet of the lake. The banks or walls of the canyon are composed of rock (limestone), which rises at an angle of about 60° to a height of approximately 170 feet. Above that elevation the banks are of a glacial deposit, composed of clay, gravel, sand and boulders, overlying the rock on the south side to a depth of from 50 to 100 feet, and on the north side to a much greater height, the slope being almost as steep as the lower part. The rock at the lower level of the canyon is completely buried in places by material from above, and only appears as an outcrop on the south side. On the north side it presents a rock face for 100 feet in the height, here the rock is rather badly decomposed. At elevation 5,300 or 140 feet above the water level, the width of the canyon is 380 feet.

The above conditions may be considered ideal from the standpoint of a hydraulic-fill dam. The surroundings are such that good borrow pits could be had near the site, and at such a height above the work, that no difficulty would be experienced in regard to grades in the sluices; an ample water supply exists in the river, which would of course need to be pumped.

The matter of unwatering the site during construction is comparatively easy. The proximity of rock to the surface would permit of the construction of a tunnel of comparatively short length, which could be built with the ultimate object of discharging the storage.

Hydraulic-Fill Materials

Regarding what constitutes a good material for this class of construction, the following extracts are taken from Mr. Schuyler's paper, Transaction Am. Soc. C.E., vol. LVIII, quoted before. He says:—

> "As far as the writer's experience has gone, it is his opinion that the best material for hydraulic-fill dams is rounded gravel, sand and boulders, intermixed with about 25 to 35 per cent. of clay. The rounded

rocks roll more readily than broken angular chips, and clay acts as a lubricant to assist in transporting the heavier materials.

"The most difficult material with which to build such a dam is pure clay unmixed with sand, because it is unstable until the water is drained from the mass, and drainage is slow. The shrinkage, therefore, is much greater than in other materials, and there is greater likelihood of the opening of shrinkage cracks, months after the work is finished, through which leakage could start if the dam were put in service too soon after completion. When clay is finally consolidated, however, it makes a dam which can have no superior for water-tightness.

"As a core for coarser and more stable materials, clay is extremely desirable, and its presence with sand, gravel, and rock in sufficient proportion to form one-fourth to one-third of the volume of the dam to be segregated by water and placed in the centre of the mass, makes it more easily worked, more useful, and more valuable for safe dam construction than in any greater proportions.

"While clay is doubtless the most impervious of all earth, it is not indispensable in the building of water-tight dams. The volcanic ash soil of the Snake River Valley has none of the characteristics of clay, and yet it is so finely divided as to make a water-tight embankment when properly moistened and compacted. Glacial flour, which has no resemblance to clay, will also make an equally good dam."

The creating of storage at Spray lakes, with whatever type of structure that may ultimately be decided upon, involves the question of transportation. Situated as the site is, up in the mountains, and at a distance of 30 miles by trail from Banff, the expense of transporting materials such a distance over mountain roads would be great, and there is the initial expense of building at least 20 miles of new road; any scheme of construction therefore which reduces the amount of materials to be transported is worthy of consideration. It has been estimated that the cost of cement landed at the site of the work would be at least $6 per barrel by the cheapest method of transportation, *i.e.*, in winter, when the roads would be good and the loads hauled large; concrete construction, with cement at such a figure, would be very expensive. A hydraulic-fill dam would reduce the amount of material to be transported to a minimum. The amount of material to be placed in the structure is greatly in excess of that for a concrete dam, but there is no comparison between the unit cost for the methods, there being contracts on record where the price for this kind of work has been 18 cents per cubic yard.

Mr. Schuyler, in his paper (vol. LVIII, Trans. Am. Soc. C.E.) quoted before, says regarding this method:—

"While economy in first cost is certainly a most potent factor in governing the choice of methods of doing any work, it is by no means the only reason which has led the writer to advocate a widespread and general use of the hydraulic-fill method of dam construction. He regards its superiority as consisting largely in the ability afforded to utilize materials which would be otherwise unfit or unsuitable due to the assorting, grading and separation of different classes of material, by reason of the dissolving action of moving water and its varying velocities, which are entirely controllable, and which permit the deposition of the several grades in making a stable dam. By this means, the course, friction-bearing stable materials may be placed on the exterior slopes, and the finer particles may be assembled in the centre of the mass to serve as a puddle core, and the ease and simplicity with which this may be done constitutes one of the strongest possible reasons aside from that of economy in cost, for using this method. In fact, by this process it becomes practic-

able, with care and skill, to build a safe and stable dam of materials which would otherwise be considered valueless. As nature does not always mingle her materials in the proper proportions to make them fit for forming a water-tight embankment without proper segregation; this selection and separation cannot usually be made by the ordinary process at practicable cost."

Construction.

The first consideration in construction of this kind, is the question of water supply under pressure. This is obtained in one of two methods—either by means of a gravity supply at an elevation above the work sufficient to insure a good working pressure, or by pumping; the former method is the cheaper. The pressure is, of course, of prime importance, and as a rule at least 100 pounds per square inch is required with a discharge up to 20 cubic feet per second. Where the supply of water and the pressure is secured by pumping, power has to be secured.

At this site, so far as is known, there is no adequate gravity supply of water available; it is therefore proposed to obtain the required supply of pumping, a method for which the site is well adapted.

Power for Construction Purposes.

At the upper end of the basin, and in the main branch of the river, there is a fall with an available head of 50 feet. The flow varies, but during the season when sluicing could be done, the amount available would be between 150 and 200 second-feet. When the basin is filled, the fall will be drowned out, but during construction it would be available for power. It is proposed to install a temporary power plant at this fall. This could be done very economically, and such a plant would supply all the power necessary for the construction of the dam; the fall is about a mile and a half from the site of the proposed work, so the transmission lines would be short. Altogether, the site seems peculiarly adapted to this type of construction.

Dam.

The dam would occupy the same position as of that proposed for a masonry dam, *i.e.*, about 2,500 feet from the mouth of the canyon. It would be 380 feet long on top and 30 feet wide, and from foundation to crest, the total height would be 160 feet. A design has been prepared of the structure, and quantities estimated.

The upstream slope is 3 to 1, and the downstream 2 to 1. Riprapping is also included for each slope, but owing to the material this may be found to be unnecessary. A rock toe is proposed at the up and down stream side of the dam.

The necessity for a core wall in the heart of the dam cannot be definitely decided until the foundation is uncovered. Regarding the advisability of the use of a core wall in connection with hydraulic-fill dams there seems to be a wide difference of opinion; there is no lack of examples of both the use and omission of core walls. The Terrace dam and Necaxa dam No. 2 are good examples of the use of core walls; in the former case the wall fills the lower part of the canyon and rises to a height of 70 feet, and in the latter case the core wall extends down through the underlying material to an impervious stratum and rises to within a short distance of the original surface of the ground. On the other hand, a notable example where the core wall is omitted though not entirely is the Coquitlam dam in British Columbia, at the outlet of Coquitlam lake. The core wall being only built on the side of the confining valley where rock is in place.

In connection with the need of core walls, in a discussion of the paper before quoted, Mr. Schuyler says:—

"The fixed objection which the writer has to a core wall of masonry or concrete in the centre of an earth dam, especially of large dimensions, is that it introduces an element entirely foreign to the nature of the body of the earth structure, acting as a huge knife to sever it in half, destroying its homogeneity, and preventing the complete knitting of the mass as a whole in a manner that must best subserve the purpose for which it was built. A core wall must necessarily be built comparatively thin to be reasonable in cost, and must be subject to the minor defects of construction incident to all such work, and subject also to rupture from the possible uneven settlement of the earth on either side of it."

The placing of a core wall in the dam depends upon the nature of the material upon which it is founded. If based upon an impervious stratum of clay, or material to which a good bond may be secured, its introduction seems unnecessary. On the other hand, where the dam is placed upon rock, it would appear that some method should be used to prevent possible percolation along the line of contact, either by trenches filled with material bonded to the dam, and homogeneous with it, or by a low core wall. Mr. Schuyler gives it as his opinion that: "A core wall of moderate height in an earth dam founded on bedrock, is a most useful and necessary element to form a bond between the earth embankment and the bedrock on which it rests, but for this purpose it does not need to be carried higher above the rock surface than is reasonably necessary to form such a bond."

It is proposed to make the unwatering tunnel serve the double purpose of taking care of the flow of the river during construction, and of serving as a means of discharging the water from storage when complete. This tunnel will be placed in the solid rock at the north end of the dam, the entrance at the upper end being constructed with proper intake structure, and the tunnel lined throughout with concrete. The discharge will be controlled by suitable valves placed in a chamber excavated in the rock, and situated above the tunnel, access to which will be by means of a shaft sunk from the surface at some distance from the dam. This tunnel will be of ample size to take care of any flood discharge that may occur.

Spillway.

A spillway to supplement the sluice tunnel at times of excessive flood may be provided at either end of the dam, depending upon the nature of the material encountered.

Dimensions.

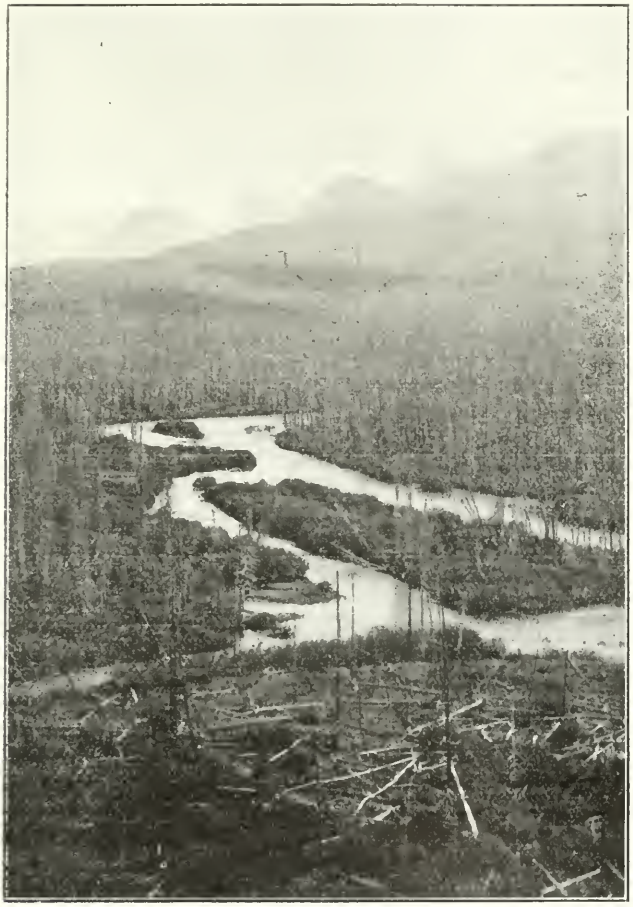
The dimensions, on which the estimate of cost given later is based, are here given:—

Length on crest	380 feet.
Top width	30 "
Height	160 "
Upstream slope	3:1
Downstream slope	2:1
Contents	550,000 cubic yards.
Tunnel:—	
Length	900 feet.
Section	1,548 square feet.
Maximum estimated flood, 20 c.f.s., per square mile	4,000 c.f.s.

The cost of the dam itself has been based upon the above figures.

Clearing.

The total area to be flooded is 3,024 acres. Of this amount, 464 acres is water surface, the remainder being covered to a greater or less extent with timber, etc.



Taken by K. H. Smith.

Spray River (above Canyon).

A large part of the country in the basin has been burned over (see reproduction page 95), but not completely, leaving the trunks standing. The heaviest stand of dry timber occurs between the lakes and the south end of the basin; here the timber is mostly jackpine, running from 16 inches to 20 inches in diameter, and fairly straight; a second growth of jackpine has appeared, but it is for the most part small, though thick in places. The part lying above the junction with Hogarth creek is fairly clear; the part between the mouth of the canyon and the proposed dam site has been well covered with jackpine, but a considerable quantity has been cut for mine props within the last year. In the district surrounding the lakes, the standing growth is generally green and of small size, though scattered clumps of jackpine and spruce ranging from 10 inches to 20 inches are to be found. The location and kind of trees is indicated upon the plans of the area, and in estimating the cost of the storage,

the cost of clearing has been included. No attempt has been made to separate the open areas from the timbered, estimates being made on the basis that the total area not under water, *i.e.*, an area of 2,560 acres, is to be cleared.

Trails.

Upon the creation of storage at Spray lakes, it will be necessary to relocate some of the trails. For the most part, the trail along the west side of the lower lake will be undisturbed, but a change of location of the trail coming from White Man's pass at the upper end of the valley will be necessary, also of the trail leading from the lakes to mount Assiniboine. It will be necessary to locate a new trail around the east side of the basin leading to Kananaskis lakes and up Hogarth creek, also around the south end of the basin, branching off from the mount Assiniboine trail. These changes will involve little work, and may be done at small cost.

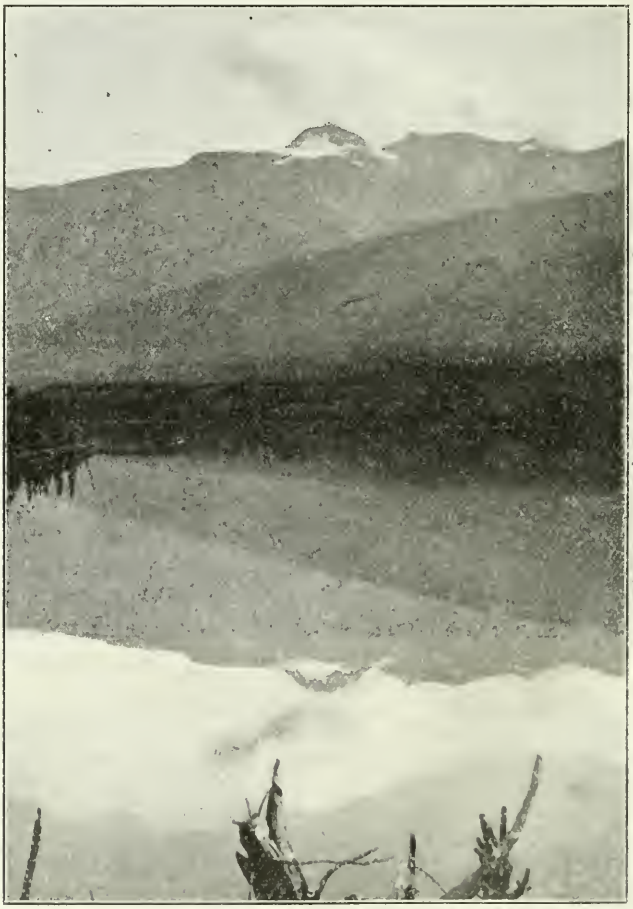


Photo by K. H. Smith.

Spray Lake.

Temporary Power Plant.

The Spray falls, which will be flooded out when the storage basin is created, has a direct drop of 40 feet; immediately above the main fall are a series of

cascades of from 1 to 3 feet each, so that by going upstream a few hundred feet the available head could be increased to 50 feet. There are a number of points where the stream flows over the exposed rock and at one of these places, the river can be easily intercepted by a temporary dam across the stream, a structure about 100 feet long being necessary. In order that this head may be obtained, a conduit 1,000 feet long would be necessary; this could be an open flume.

In order that difficulties of transportation may be reduced as much as possible, it is proposed to use two units of about 400 b.h.p. each. An estimate has been made of the probable cost of this plant, and included in the cost of the dam.

The gross available head for the plant is 50 feet, and the estimated discharge during the working season 200 c.f.s.; this is taken in place of the low flow because with the exception of work on the sluice tunnel, little work could be done during the winter months.

Head	50 feet.
Discharge	200 "
E.h.p.	800
Proposed installation	2—400 h.p. turbines.
	2—225 k.w. generators

Construction Road.

Besides the construction of the dam and other preliminary construction required, it will be necessary to build in the neighbourhood of 20 miles of wagon road; of this, about 7 or 8 miles will involve considerable grading, the remainder being comparatively easy of construction. At present there exists a good road from Banff to the junction of the two branches at the end of the Goat mountain; from there the best route for a road to the lake follows up the north branch, and into the valley by the north end of the lakes. The part from the end of Banff road to about a mile east of White Man's pass would be the most difficult of construction.

Estimated Cost of Creating Storage.

1.	Roads, camps and telephone	$25,000.00
2.	Temporary power plant (800 h.p.)	30,000.00
3.	Excavations and preparation of foundations, etc.	40,000.00
4.	Sluice tunnel and control works	117,000.00
5.	Dam, 550,000 cubic yards, complete	165,000.00
6.	Clearing of basin, 2,560 acres	38,000.00
7.	Contingencies of construction	41,500.00
8.	Engineering and Inspection	28,000.00
9.	Interest during construction, etc	29,500.00
	Total	$514,000.00

Cost.....$3 per acre-foot.

BOW LAKE STORAGE.

General.

Bow lake at the head of Bow river is at an altitude of nearly 6,500 feet above sea-level, and may be considered the source of the river. On the south side of the lake the mountains rise from the water's edge from 2,500 to 3,000 feet,

but on the north and east sides the slope is gentle, the valley wide, and the mountains not so high. About 3 miles to the north west of the lake, is Bow pass at an elevation of 6,870 feet, forming the upper limit of the Bow basin.

The mountains to the south and west of the lake are for the most part perpetually snow-capped, immense fields of snow lie upon the top of Bow peak, mount St. Nicholas, and others in the vicinity; these feed the two glaciers that discharge into the lake. These two glaciers are the famous Crowfoot and Bow glaciers. (See reproduction page 99.) The former is the smallest and very beautiful, deriving its name from the form it takes; it enters from the south, the foot of the glacier being within a hundred yards of the lake shore. Bow glacier lying at the west end of the lake is much larger; the foot is one mile from the shore, the intervening distance being filled up with the debris from the glacier or moraine; over this the creeks from the forefoot find their way.

Area.

The lake is approximately 3 miles long, from east to west, and varies from a quarter of a mile to nearly a mile in width. (See reproduction page 98.) The lower portion about 100 acres in extent being 3 feet lower than the upper part, and connected with it by a creek of considerable width, from 100 to 200 yards wide. The total area of the lake is 800 acres and the area tributary to it roughly 30 square miles; lying as it does at a comparatively high altitude, the drainage area is peculiar. The surrounding mountains are classed among the high peaks, Bow peak being slightly over 9,000 and the majority over 10,000 feet. Under these circumstances, it is to be expected that the run-off will occur to a great extent during the warmer part of the summer. Information as to the time of ice formation on the lake in the fall is not available, nor the approximate date on which the ice leaves the lake.

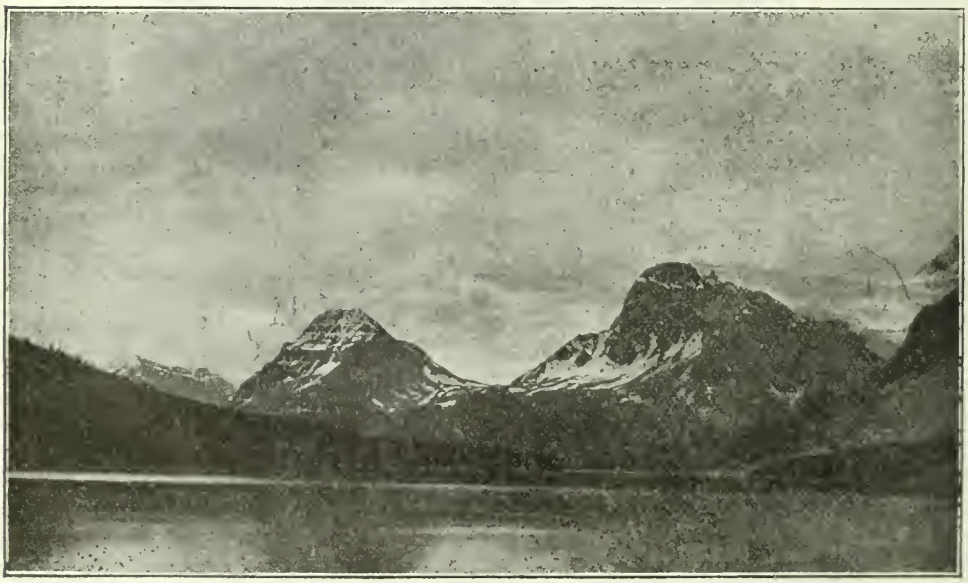


Photo by M. C. Hendry.

Bow Lake—Looking East.

Investigation.

In the summer of 1911, when a general reconnaissance was made of the Bow basin, in the search for possible storage sites, Bow lake was included. After a general investigation of the lake and its surroundings and a rather careful examination of the outlet, it was decided that a survey in greater detail was justified. Accordingly a party was sent up to the lake in August, 1911. Owing to the difficulty of transportation, and distance from the nearest base of supplies, Banff, it was decided not to survey the lake in any great detail but to work up thoroughly the outlet end of the lake.

Photo by M. C. Hendry.
Bow Lake—Looking East and showing Ice Field above Crow Foot Glacier.

A stadia traverse was run around the lower part of the lake, also around the upper part for part of the distance; the traverse was confined to one side only, points being located at frequent intervals on the opposite side by stadia and triangulation.

Cross sections were taken of the banks of the lake at every station, with hand level and tape, and the shores of the lake contoured for a height of thirty feet. The outlet end of the lake was worked up in greater detail, a complete stadia survey being made and two dam lines located. In addition a couple of test pits were dug, revealing a very compact boulder clay overlying the rock in the vicinity of the dam site.

Storage Capacity.

The accompanying plans were plotted from the surveys made. A study of them revealed the fact that the height to which the water in the lake might be raised was governed by the height of the ridge of land to the north of the lower lake; this is at an elevation above 6,530, but in places drops below that elevation; by building a short embankment, however, the water might be raised to 6,530. This was therefore fixed upon as the upper level of the storage, the lower level being the present normal lake level.

The amount of storage secured by raising the water to elevation 6,530 is 27,411 acre-feet, equivalent to a discharge of 466 c.f.s. for one month of thirty-one days.

Sources of Water Supply.

The lake is fed from a number of sources, the two principal ones being the Bow and Crowfoot glaciers. The former discharges into the upper lake at the west end; the stream flowing from the glacier varies in size with the temperature; where it enters the lake it breaks up into a number of small streams, which at time of examination would aggregate about 50 c.f.s.; this was visible discharge, but owing to the nature of the underlying material the underflow must bear a large ratio to the surface flow. At the northwest corner of the lake, a stream, which is the actual source of the Bow river, enters (see reproduction page 102); this rises about 3 miles west of the lake upon the Bow summit, and is for the most part spring fed; it has drainage area for several square miles and at the time of examination had a discharge of from 10 to 20 c.f.s. Along the north side of the lake there are a number of small creeks with a flow of from 2 or 3 c.f.s. to 8 or 10 c.f.s. discharging into the lake; on the south side there are only two or three streams entering the lake, the principal one coming from the Crowfoot glacier; this had a discharge of 10 to 12 c.f.s. when examined. There is no doubt that springs discharging considerable quantities of water exist, as a number of pot holes of from 10 to 15 feet in depth are filled with water; these stand with the water about 10 feet above the lake level, and from the appearance of the water must receive their supply from an underground source. During the time the surveys of the lake were made in the latter part of August, the discharge from the lake was between 125 and 150 c.f.s.; earlier in the season this is, no doubt, very much exceeded.

Process of Filling.

Measurement of the discharge from the Bow lake have not been made owing to the difficulty of access, and the foregoing figures are based upon estimates made of the different discharges; it is thus impossible to draw up diagrams showing the process of filling and emptying the proposed reservoir though certain conclusions have been arrived at.

On the assumption of 27,411 acre-feet of storage, if the process of filling was commenced May 1 and continued during June, July and August, with a constant inflow into the basin, it would require 112 c.f.s. to fill the basin. There is therefore no reason to doubt that there is sufficient run-off into the lake to provide this amount of storage, and make up the loss due to evaporation.

Manipulation of Storage.

One objection to this storage basin, is its distance from the point of utilization, and in view of what has occurred during the winter of 1912-13, the objection appears to be a good one.

There is also the question of attendance in connection with regulation and some method of communication; the objection to placing an attendant at the lake, during the winter, is the difficulty of securing a man who would be both suitable and willing to remain at the lake during the entire winter, for at this season it would be difficult to get out and in. If a telephone was placed at the lake, a line would have to be built from Laggan, a distance of nearly 30 miles.

It is proposed, however, to make special use of this storage; during the season just mentioned it was necessary to draw on the storage during November and December, and the water would be badly needed during the early spring

months; the idea is, therefore, to release the water from Bow lake during November and December, or March and April, depending upon the season, the latter period being preferable as conditions are improving and the loss due to ice troubles would be reduced to a minimum. No attempt at regulation would be made, but a uniform discharge over a period of one month could be maintained. Any necessary regulation could then be made more easily by means of storage in closer proximity to the point of use. By operating in this way, the services of an attendant at the dam could be dispensed with, and the loss due to the formation of ice could to a large extent be overcome.

Assuming that all the water would be released in one month, a continuous discharge of 466 c.f.s. would be secured at the lake. In arriving at the benefits to be derived from storage in the lower river, only a discharge of 400 c.f.s. has been used, it being assumed that the rest is lost between the point of storage and the point used.

Dam.

The site of the proposed structure is 400 feet downstream from the outlet of the lake. About that distance downstream the river makes a sharp bend to the left, and then again to the right, forming the letter "S." On the right hand side the bank rises steeply for a height of 15 feet, then slopes more gently, rising to an elevation of 35 feet above the water in a distance of 150 feet, where the solid rock is exposed, forming the banks of the river. On the left side the slope is more gentle, rising gradually from the surface of the stream to a height of 35 feet in about 400; the rock is overlaid as on the other side by a glacial deposit of boulder clay; a short distance upstream, on the left side, the rock is exposed, but not at the dam line. The stream at this point is fifty feet wide, and flows over boulders and gravel overlying the solid rock.

The bedrock, where exposed on the left side, is a thinly-bedded limestone, and is badly disintegrated (see reproduction page 104). On the right hand side this is not the case, the rock exposed being in good condition.

The structure involved in creating the storage will be a dam 650 feet long, the centre portion of which will be a hollow-type spillway section of concrete provided with sluiceways for discharging the water, and also providing for extra discharge if necessary.

Spillway.

The spill section would be placed in the bed of the stream, and from foundation to spillway elevation would be between 35 and 40 feet, depending upon the depth at which the solid rock lies. The spillway section will be provided with concrete wing walls at each end, and with either a concrete core-wall or steel sheet piling extending through the earth fill section.

A provisional section has been prepared for estimating purposes, and is shown in the accompanying drawings. It is proposed to place three 4-foot by 4-foot sluices in the dam to provide for discharging the storage; these will be provided with suitable gates and operating mechanism and will provide for additional discharge should the 100 feet of spillway prove inadequate at flood time. This, however, is only a remote possibility as a run-off of 25 c.f.s. per square mile would only give a discharge of 750 c.f.s., while with an overtop of 1 foot the spillway would discharge 334 c.f.s. and with 2 feet overtop, 945 c.f.s.

Embankment.

At either end of the spillway section, the dam will be made up of an earth embankment carefully built of boulder clay found in the immediate vicinity, that on the right hand side 130 feet and on the left 400 feet long. The embankments will rise to elevation 6,535, or 5 feet above the upper level of the basin.

The slopes of the embankments will be 2 : 1, the upstream sides will be rip-rapped to a depth of 1 foot for the whole of the surface, and washed over with a cement grout, and they will be 10 feet wide on top. A concrete core wall or sheet-piling would be placed through the centre of the embankments, and joined to the wing walls of the spillway.

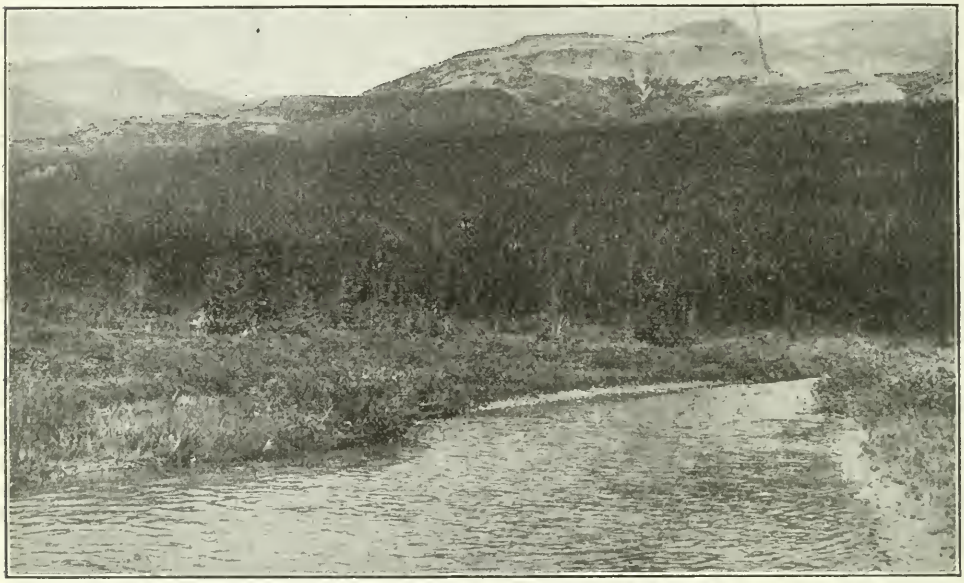


Photo by M. C. Hendry.

Creek entering upper end of Bow Lake.

Photo by M. C. Hendry.

Bow Lake—Looking towards outlet.

In addition to these, it will be necessary to build an embankment opposite the outlet of the upper part of the lake at the point indicated on the plan; this will be 450 feet long and 8 feet high at the highest point. By placing the embankment at this point, water will be prevented from escaping down what is apparently an old bed of the river, lying to the north of the present one, and joining it about a mile-and-a-half downstream.

Construction Difficulties.

The creation of the storage at this point does not present any engineering difficulties. The greatest difficulty to be overcome is transportation; at present the only means of communication is by pack trail, and though a considerable length of new trail has recently been constructed, the cost to convert it into a wagon road would be prohibitive. Winter transportation seems to be the solution of the difficulty; during the summer all the Bow valley flats below Hector lake are soft, but in the winter, for little outlay, a first-class road could be built. Above Hector lake there are no difficulties to be encountered either in the way of hills or soft spots. Once the bottom was secured, heavy loads could be transported with ease, and the cost should not exceed $8,000 to $10,000 at the outside.

Transportation being secured, the cost of undertaking would be small, supplies being placed on the ground during the winter and the work prosecuted during the summer. It would be possible, if proper precautions were taken, to place the central portion of the dam during the winter or low-water period.

Estimated Cost.

The estimated cost of construction is as follows:

Clearing	$5,500·00
Dam—Earth section	11,000·00
Rip-rap	4,300·00
Spill section	30,000·00
Wing walls	15,000·00
Core walls	8,000·00
Valves and installation	6,000·00
Excavation	1,200·00
Miscellaneous:	
Winter road	10,000·00
Engineering and contingencies, etc	14,000·00
	$ 105,000·00
Available storage	27,400 acre-feet.
Cost, per acre-foot	$3 83

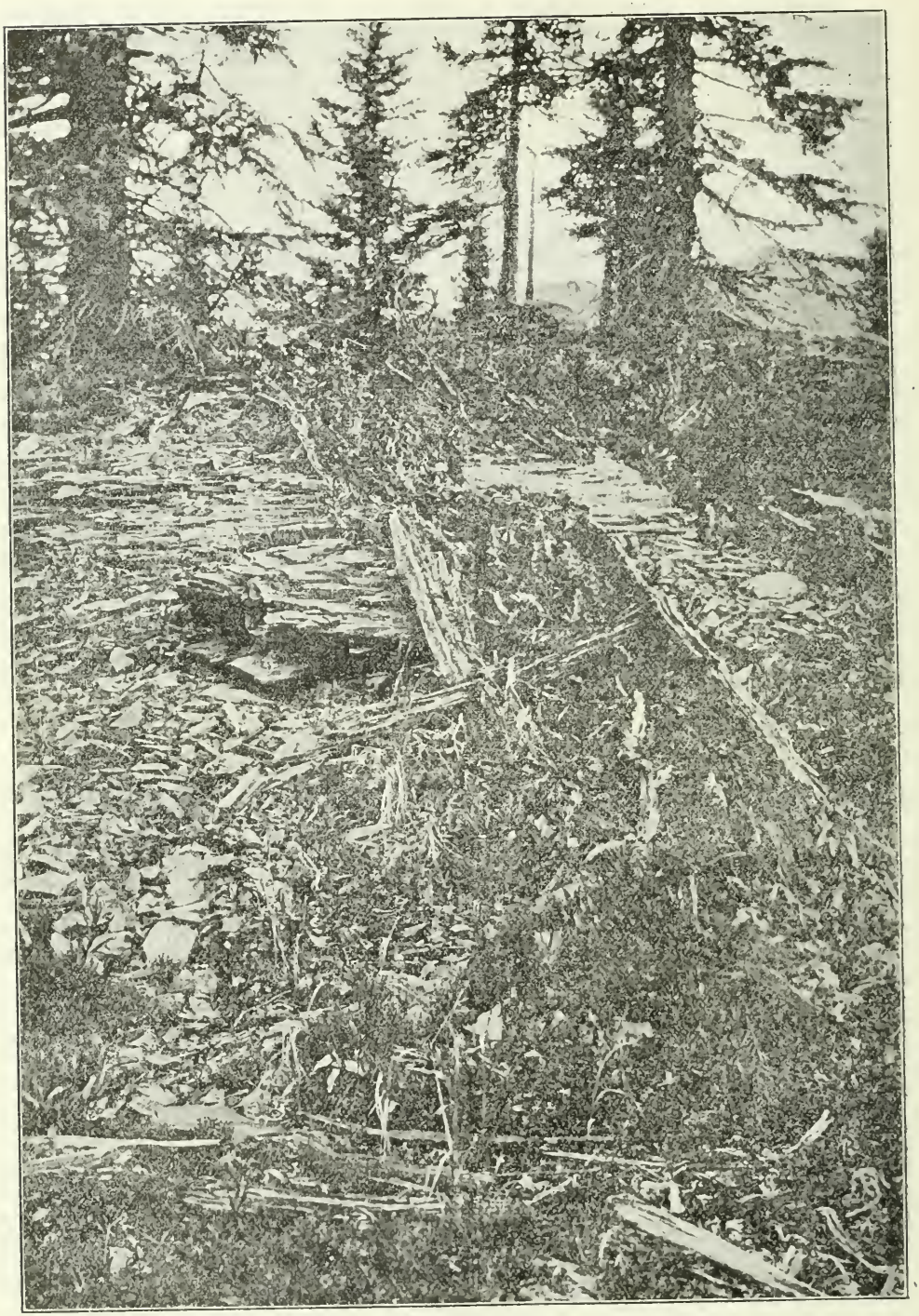


Photo by M. C. Hendry.

Bow Lake rock at Dam site.

CHAPTER IX.

ELBOW RIVER.

General.

The Elbow river is one of the chief tributaries of the Bow, to which it adds its waters within the limits of the City of Calgary; from source to mouth it is over 60 miles in length. It rises in the eastern slope of the Rockies, the source being near the main continental divide, and it has all the features of a mountain stream.

The total drainage area of the Elbow river is 482 square miles, about 255 square miles of which lie above what may be termed the power-producing section. Near the head of the river, the drainage area is all at a considerable altitude, and, in consequence, the discharge is very susceptible to changes in temperature. The flood period occurs toward the latter end of May and during the month of June, when the flow of the stream is augmented by the water from the melting snow in the mountains. Owing to the steep slope, the run-off is very rapid and the variations in the stream flow very great, due not only to hot weather, but to the sudden heavy rains which occur in the region.

The river-bed is composed for its entire length of gravel and detritus, especially in the mountain portion, where the gravel overlies the bed rock to considerable depths, the latter being exposed only at isolated points.

These conditions are ideal for underflow, the flattening out of the slope of the stream allowing the water under the slower velocity to sink into the loose material composing the bed.

Discharge.

Gaugings have been kept of the Elbow river for a considerable period, and with very few omissions since May, 1908. The station is just above the junction with the Bow river and gives the total discharge of the river; no other gauging station has been established, but miscellaneous meterings have been made at other points on the river. These have, with few exceptions, been made at other than the low water period, consequently it is nearly impossible to arrive at any definite conclusion as to the discharge of the upper part of the river.

Isolated gaugings were made in the vicinity of Canyon creek during the winter of 1910-11, and may be used as an indication of the probable discharge at that time, though the discharge, due to ice conditions, may vary greatly from day to day or even from hour to hour. The fact that under-flow occurs has a very material bearing on the discharge. This portion of the run-off is not recorded, but is, nevertheless, available, for the erection of a structure in the stream bed on a solid foundation would intercept all the flow, thus any recorded surface flow must be increased to arrive at the true discharge of the stream.

Tables are included giving the discharge of the Elbow river at Calgary, also a curve giving the mean monthly discharges has been plotted and is included. (See diagram, Plate No. 4.) The table reveals the fact that the surface flow is at times as low as 100 c.f.s., and may be even lower, though what amount should be added to this to give the combined surface and underflow discharge is rather hard to determine. In March 14, 1911, gaugings were made above and below Canyon creek which was practically dry; the results were 92 and 113 c.f.s.

respectively, or a difference of 21 c.f.s. in two sections 200 feet apart, which may be taken as rather conclusive evidence of the presence of underflow. In February, 1911, gaugings were made at the same two points, and gave 138 c.f.s. above and 135 c.f.s. below. Mr. Mitchell, in a report upon the possibilities of power on the Elbow, states that, in his opinion, the underflow may be taken as forming 25 per cent. of the total discharge of the river in the vicinity of Canyon creek; no attempt has been made to verify this opinion by actual measurement, as the construction of a tight weir would be involved, but there seems little reason for disputing it, in fact, quite possibly this figure might be exceeded.

From the tables and the foregoing estimate of underflow it is concluded that the total mean discharge of the river at Canyon creek will not be less than say 120 c.f.s. This low flow would extend over the period from December 15 to March 15.

Power Section of River.

In May, 1911, a reconnaisance of the Elbow river was made and from the examination of the river it was decided that the possibility of producing power was confined to the section lying between the 20-foot falls in section 17, township 22, range 6, west 5th, and the east boundary of section 14, township 22, range 6, west 5th. Below Canyon creek for a distance of about 2 miles the river is confined in a narrow valley by banks from 150 to 200 feet high; below this section the fall in the river is less, so nothing would be gained by going below the point indicated.

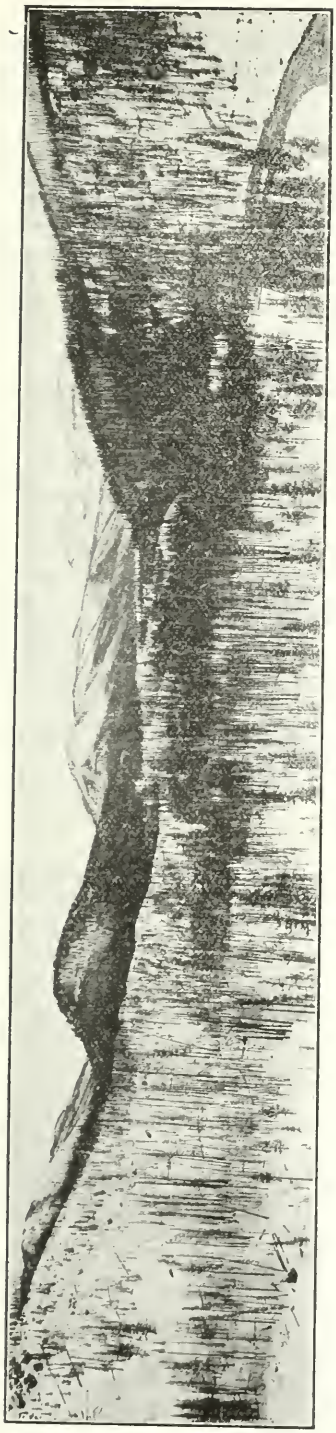
Between the 20 foot falls and the Canyon creek the river flows through what is practically a continuous canyon. Above the falls the valley is wide and flat and it was hoped that advantage might be taken of the natural fall and the wide valley above for a power site but no feasible dam site exists in the vicinity with banks of sufficient height. There are several possible locations below the falls to which the same applies, but the only one found is at a point a few hundred yards above the mouth of Canyon creek. One site lying above this was examined in detail, which in itself was suitable in every way, but the existence below it of a very high cliff and rock slide on the north side precluded the building of a necessary flume, so that point had to be abandoned.

The height of the cliffs and adjacent benches determine the height to which the dam, necessary in connection with a flume line, may be built. In any scheme that has been evolved for the development of power on the Elbow, a flume line has been an essential part; the comparatively low discharge necessitates a high head development to insure economical development. The general idea of the development has therefore been, to develop part of the head by a dam and to secure the remainder by carrying the water along the benches to some convenient point and there convey it to the valley, thus utilizing the natural fall in the river below the dam.

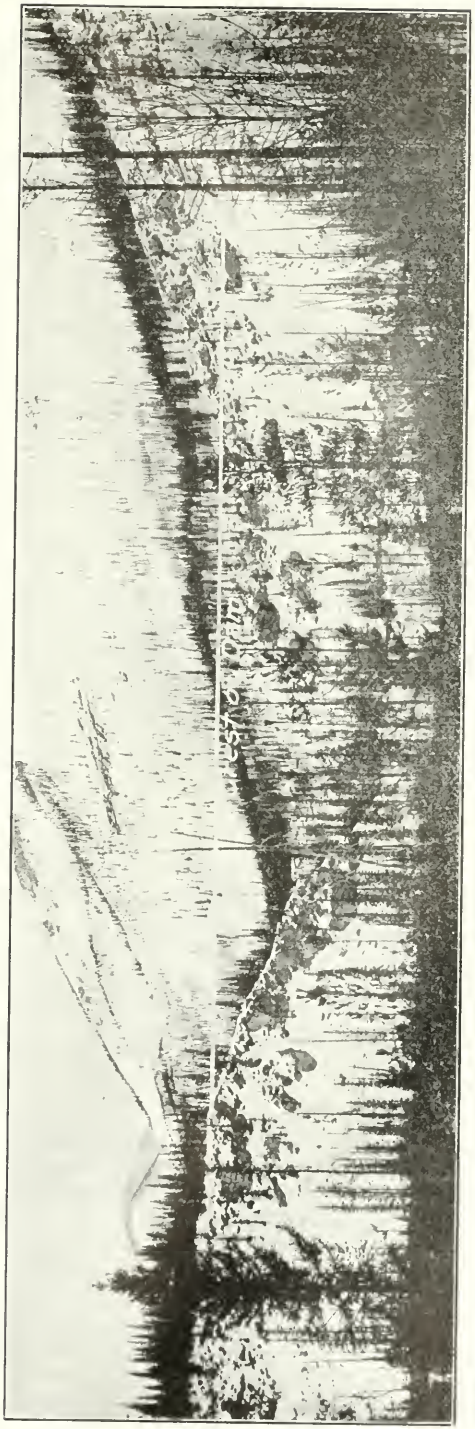
Storage.

The flat above the 20-foot falls narrows rapidly about 2 miles up the valley, and is confined by the high mountains. The river is very steep and rough and at the extreme end issues through a narrow gap between two mountains; here the walls are formed of limestone.

Just above the gap there is a very wide valley (see reproduction page 107), the whole bottom of which is covered with gravel, and the stream finds its way through this by a number of small channels. The valley is about 3 miles long and varies from 1,200 to 1,500 feet in width, and with the gap at the lower end forms an ideal site for storage; this question will be dealt with later.



Elbow River Storage Basin.



Elbow River Storage Dam site.

Power Development.

The study of the situation during reconnaissance leads to the conclusion that there is only one scheme worthy of full consideration. This involves a dam above the Canyon creek, a flume line following the bench lands on the north side of the river, and a power house placed in the river valley about a mile and a half below Canyon creek. In May, 1911, a party was placed in the field and this general scheme was developed in detail; a survey was made of the dam site in sufficient detail to admit of preliminary plans and estimates for the structure being made, care being taken to locate all evidence of rock in place and obtain such additional information as might be necessary. The flood line was defined in a general way, the upper limit being located at all vital points. The flume line was located and a contour survey made of the country adjacent to the line including the site of the proposed head-works, penstock line and power-house. This information is all embodied in the accompanying plans.

Power Dam.

The site of the dam is a few hundred yards above the mouth of Canyon creek where the river flows between two high rock cliffs (see reproduction page 107). The south bank rises to a height of 80 feet above the surface of the river, while on the north side it rises to 90 feet. The bank on the south side slopes back gradually from the top of the cliff, rising to an elevation of several hundred feet, while on the north the height of the banks is about 175 feet, 125 to 150 feet of which is rock cliff, a dam at this point would raise the water to a sufficient height to allow it being carried on the bench in a flume. It would also back the water upstream to a point about a quarter of a mile above the 20 foot falls, flooding an area of about 80 acres.

The lower hundred feet of the dam is not over 250 feet in length. An approximate estimate of the cost of the dam has been made and is given.

Flume and Penstock.

It is proposed to construct the conduit between the power dam and the forebay or standpipe above the power station of wooden staves, banded with steel, having a circular section 84 inches in diameter. Such a flume when well built of good timber is tight and efficient and has a life of from fifteen to twenty years, depending on earth and water conditions; it is elastic, easy of transport and construction, offers a minimum frictional loss to flowing water and is above all, economical in first cost and repairs. The total length of flume is about 7,500 feet, most of which will be laid in shallow earth cut on the sides of the gravel benches, and would be subjected to but a few pounds pressure.

The flume line as located was assumed at an elevation of 4,820, the water surface being 4,840. On this assumption it was run as nearly as possible to grade. It follows along the top of the first bench on the north side of the river, crossing Canyon creek about 150 yards from the mouth, on a trestle. It then keeps up on the second bench at a distance from the river, varying between two hundred feet and a quarter of a mile. At the lower end of the flume a regulation chamber or forebay is proposed, and leading from it to the power house a penstock (wooden stave pipe) 84 inches diameter and 1,600 feet long, will be necessary. The larger diameter is designed to reduce the velocity and avoid dangerous water hammer in so long a pipe, which would also be fitted with relief valves at the lower end. The penstock would be laid in a trench conforming to the general grades of the hillsides and benches and be amply provided with concrete anchorages.

Forebay.

The flume will terminate at the lower end in a concrete chamber surmounted by a large steel standpipe so arranged and of such dimensions that it will form an intermediate reservoir of small capacity into which the water will flow from the flume before commencing its flow down the penstock. This chamber will have its bottom well below the bottom level of the inlet at the dam and the top of the standpipe well above the level of the dam crest and will thus also act as a surge tank or species of safety valve for the large flume as well as for hydraulic regulating purposes.

Power Station.

The site of the power house is just west of the eastern boundary of section 14, township 22, range 6, west 5th, and at the lower end of an island to be found in the river at that point (see reproduction page 114), a dry channel of the river would be utilized for the tail-race. The elevation of the water in the tail-race will be 4,618, and the total fall intercepted 222 feet, of which approximately 215 feet would be available for power production, giving a continuous output of 3,900 b.h.p.

Equipment.

The power station proposed would have three power units and two exciter units, the power turbines being 1,600 horse-power and the generators 1,000 k.w. capacity, the latter would be 3-phase, 60-cycles and capable of an overload for temporary peak loading. If the power is used locally it will not be necessary to transform to high tension for transmission, in which case the generators would be wound for 6,600 or 10,000 volts.

The power station would be fireproof and built of concrete and so situated as to be protected from high water by means of fills and a dyke at the head of the adjacent island.

Storage Development.

As the governing factor of this development is the water supply already discussed, the scheme of development has been worked out having in view the fact that, for the winter months, a portion of the water must be supplied from a storage reservoir. For the initial development this storage basin is not essential, but for the ultimate scheme, wherein the development is carried to the utmost capacity of the river, the fullest storage available must be employed. The only storage basin proposed under this project is that formed by the proposed storage dam in section 4, township 22, range 6, already referred to (see reproduction page 107); this basin of 23,000 acre-feet capacity will afford storage sufficient to bring the minimum water supply up to about 200 cubic feet per second (see diagram, plate No. 18). Two other basins have been considered, viz., Fisher's brook (3,500 acre-feet) and Canyon creek (4,000 acre-feet); these are, however, of small capacity in relation to their cost; they would require dams 100 feet in height and would only enter into the development at a date when increased storage facilities might be sought under urgent power demands.

Storage Dam.

The type of dam suggested for this storage basin is the same as that proposed for the power site, that is a hydraulic-fill dam, for which type the site is favourable.

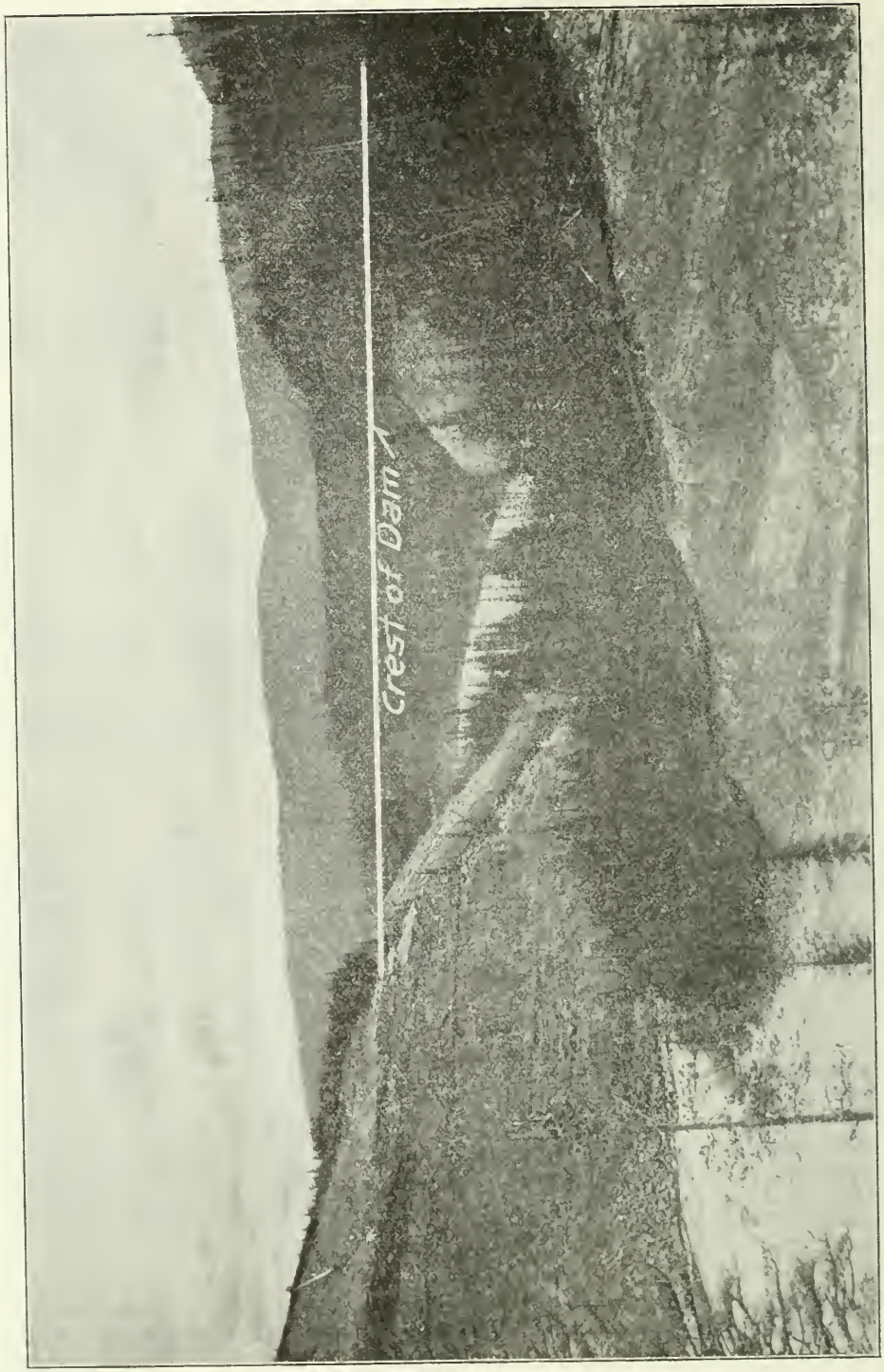


Photo by M. C. Hendry.

Elbow River—Power Dam site.

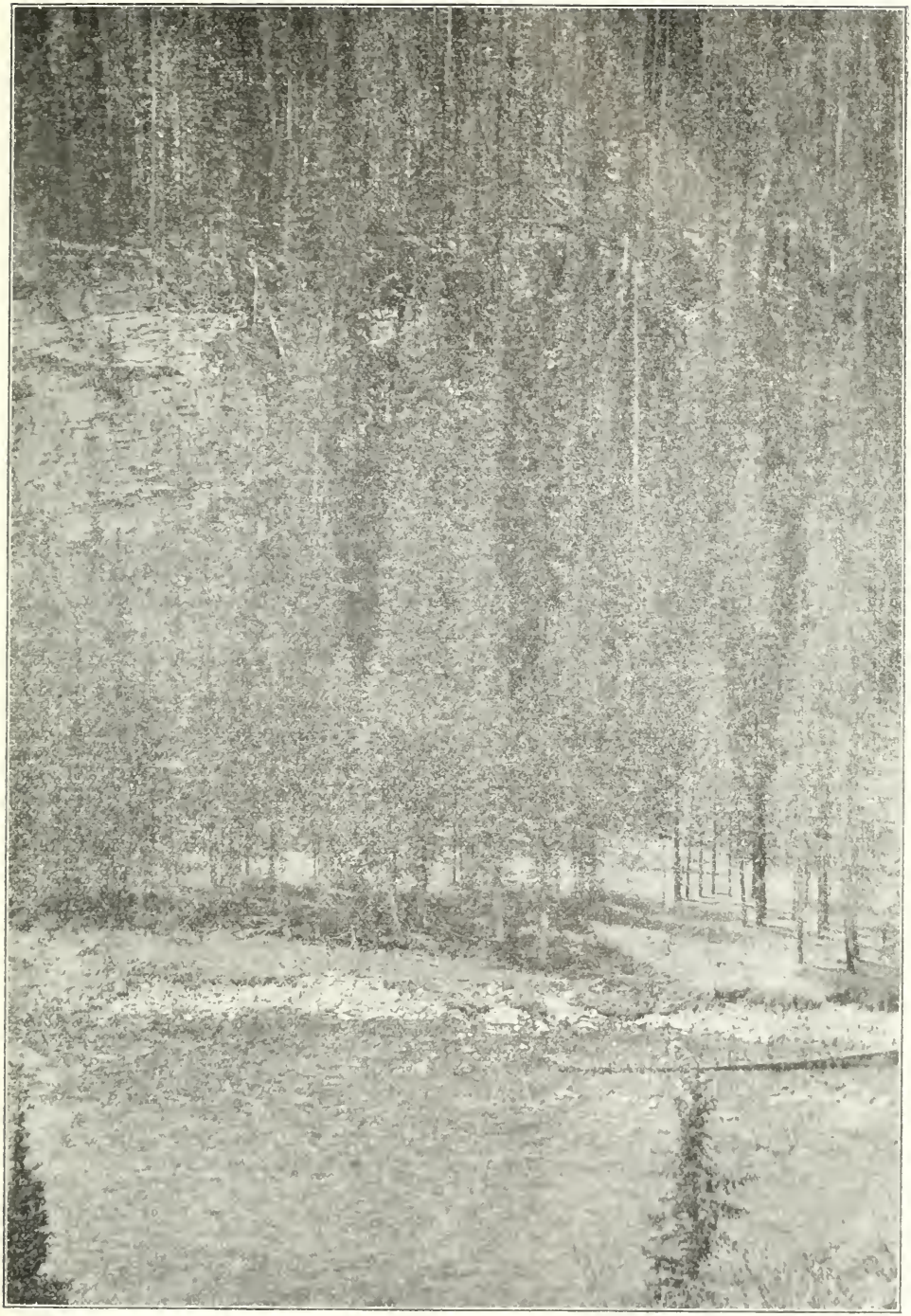


Photo by M. C. Hendry.

Elbow River—Power Dam site.

Owing to the possibility of a rock foundation throughout, it may be necessary, in order to secure a good bond between the foundation and the dam, and to prevent possible leakage along the rock surfaces, to build a core wall across the dam site extending 10 to 12 feet up into the dam.

The accompanying plans illustrate the layout of the site; an estimate of the probable cost of the work has been prepared and appears in the report.

Benefits of Storage.

The available water stored will after due allowance for evaporation and other losses provide for a continuous flow for three months and a half of 80 cubic feet per second, which should ensure a continuous flow of about 200 c.f.s. throughout the year; there is little doubt that the surplus flood water in any season will fill this reservoir.

Power Developed.

With a water supply of 200 cubic feet per second and effective working head of 215 feet, about 3,900 horse-power in mechanical energy would be developed after electric generation and transmission, say within a radius of 10 miles, it would produce an effective commercial power of 3,600 horse-power in electrical energy. The foregoing is based throughout on 24-hour service and is assumed to be the minimum power of the year, which occurs during the three winter months; for the remaining nine months, the electrical output of the plant would be increased from 3,800 to 4,200 horse-power on peak load by the use of more water, and it is proposed to arrange the equipment of the plant so as to produce a maximum of 4,200 horse-power in electrical power delivered within a radius of 10 miles of the plant.

Estimated Cost of Elbow River Development.

Transportation		$ 30,000.00
Storage Dam:—		
Sluice tunnel and control		
Dam and core wall		
Concrete spillway, etc		
		193,000.00
Power Dam:—		
Sluice tunnel and control		
Dam and core walls		
Intake, spillway, etc		145,000.00
Flume Line:—		
Pipe and excavation	$110,000.00	
Bridge, etc	20,000.00	
		130,000.00
Forebay:—		
Surge tank, etc	$ 22,000.00	
Penstocks, etc	23,000.00	
		45,000.00
Power House and Equipment:—		
Turbines	$ 20,000.00	
Generators	30,000.00	
Switch apparatus	12,000.00	
Building, etc	25,000.00	
		87,000.00

Tail race	$ 10,000.00
Transmission line	15,000.00
Engineering and contingencies, 15 per cent	98,800.00
Total	$753,800.00
Interest during construction, 5 per cent	37,700.00
Total estimated cost	$791,500.00

$200 per wheel horse-power.

Conclusions.

The scheme of developing power on the Elbow river is not an attractive one from an economic standpoint; there have been a number of applications filed respecting the development of power upon the river, and in order that these have might be dealt with the investigations were instituted with the above results.

The market for such power must, owing to the high cost per horse-power, be in the immediate vicinity of the plant. It cannot be expected to compete with power in other districts, and it is even doubtful whether the development would be warranted, as it is quite possible that power produced by a steam plant would be much cheaper; this can only be settled when the quality of the coal in the locality is known. The one thing in favour of the water power is its capacity to take care of peak loads. This plant, while nominally of 4,000 horse-power capacity could be commercially operated so as to sell from 4,500 to 5,000 horse-power on a 24-hour basis, as is quite frequently done, owing to overlapping in the loads.

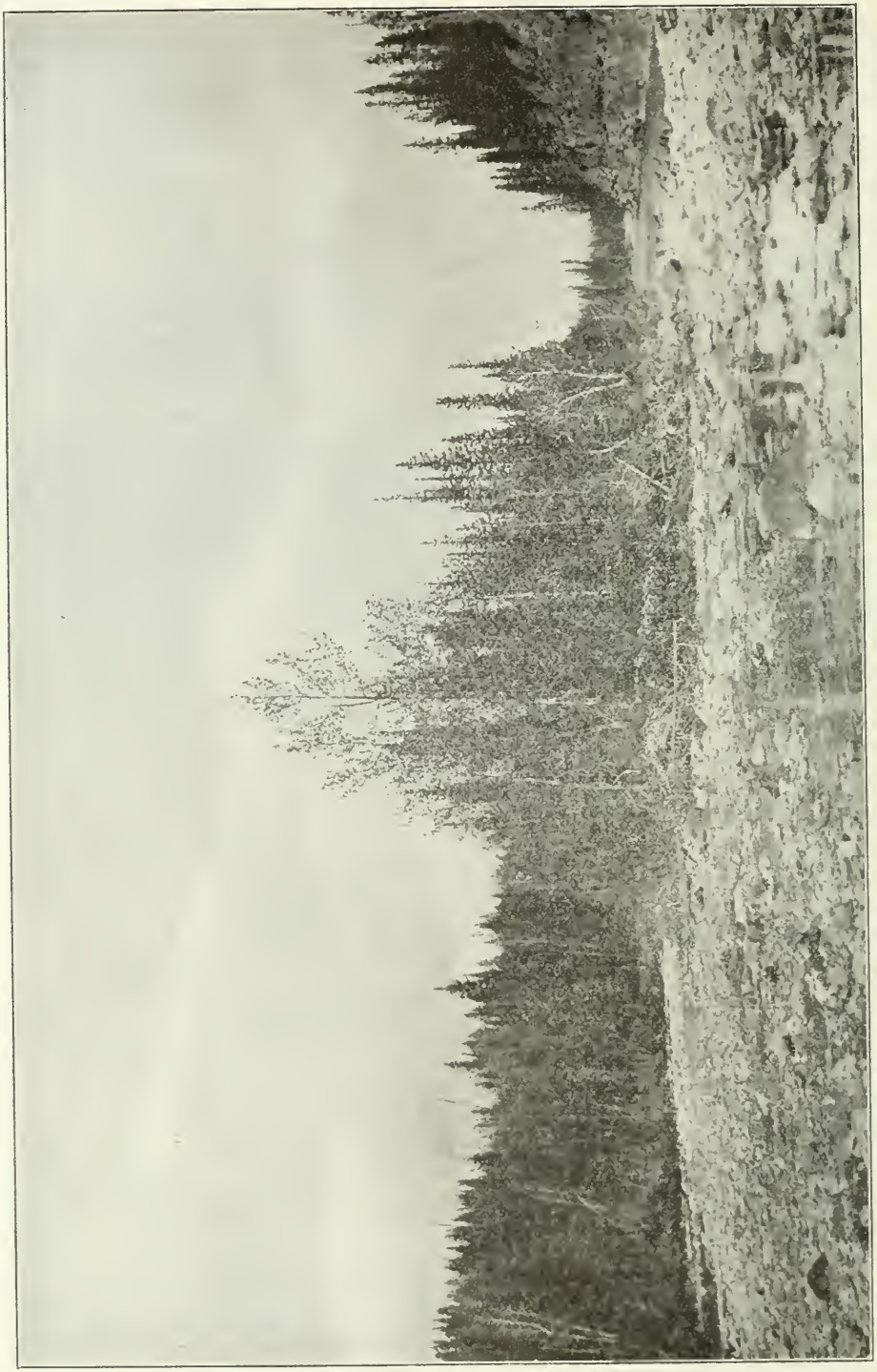


Photo by M. C. Hendry.

Elbow River Power Station Site from head of Island.

CHAPTER X.

ADDITION STORAGE INSPECTIONS.

In the investigation for storage, a general reconnaissance of the whole basin was made, and certain areas or sections were proven to be economically unsuitable for storage purposes; as these formed the largest part of the district investigated they are worthy of description.

To this particular division belong the following, which are named in the order of investigation:—

(a) Kananaskis river and lakes.
(b) Hector lake.
(c) Pipestone creek.
(d) Baker creek.
(e) Johnson creek.
(f) Redearth creek.
(g) Brewster creek.
(h) Ghost river.

The question of storage on the first two was looked into in 1911, the rest being investigated in 1912.

KANANASKIS RIVER AND LAKES.

The Kananaskis river, which flows from the south, is one of the main tributaries of the Bow, joining the latter at the head of Kananaskis falls; the western limit of its watershed forms the boundary of the Rocky Mountains park.

Source.

The Kananaskis river has its source in two lakes of the same name which are about 40 miles due south of the Canadian Pacific railway at Kananaskis; these lakes lie at an elevation of about 5,500 feet above sea-level and are situated close to the main continental divide, which here forms a barrier of snow-capped mountains. To the west of the lakes is Kananaskis pass, with an elevation of 6,200 feet, over which the trail leads, following the Palliser river down to the Kootenay. From the south, there is a small stream flowing into the lower lake; this rises near the summit of Elk pass, at an elevation of 6,500 feet.

Tributaries.

Just below the outlet of the lower lake, a small stream, which rises on the summit between the Spray and Kananaskis basins and drains the area between the Kananaskis and Spray ranges, comes in from the west. About 3 miles below the outlet we come to the forks, where from the east, flows a stream rising between Misty and Elk ranges, and draining the territory lying to the east of the lake, and west of the Misty range.

These streams and branches of the Kananaskis form its principal tributaries. Below the junction with the east fork, the streams flowing in are all short and of negligible size, the largest one being that coming in from the east a short distance south of the Indian Reserve boundary. Between these two points the river is confined between the Opal and Kananaskis ranges, and the valley is comparatively narrow. (See contour map.)

Kananaskis Lakes.

The Kananaskis lakes are spoken of as the Upper and Lower lakes, on account of a difference in level of about 90 feet, the Upper lake being at elevation 5,550 and the Lower at elevation 5,460. The Upper lake is about 2¾ miles long and 1½ miles wide. The lower is 3 miles long and half-a-mile wide.

The Upper lake is worthy of special mention from a scenic point of view—it is studded with islands and has snow-capped mountains to form a background, the addition of well-timbered shores and islands forms a picture which rivals in beauty any of the better-known lakes which are to be found in the Rockies. (See reproduction page 117). The stream which joins the Upper and Lower lakes is about 1 mile in length and, as has been noted, drops 90 feet in that distance, the fall being composed of rapids and one abrupt fall of about 40 feet.

The Lower lake, being surrounded by lower-lying hills, and having no islands, presents a less fine appearance than the Upper lake, though it is not without beauty. The fishing in these two lakes is excellent, and will be an added attraction to the locality when it becomes, as no doubt it will, a resort for tourists. (See reproduction page 118.)

As far as storage is concerned, the lakes do not offer any desirable site, the outlet of the Upper lake—the only possible point at which the water could be controlled—would require such a long structure placed in water of considerable depth (from inspection estimated at at least 40 feet) at a cost which, in view of the advantages obtained, is beyond consideration.

Further, in considering any scheme of storage on this lake, the beauty of the lake in its natural state and the extreme probability of its becoming a summer resort in the near future should not be lost sight of.

Below the Lower lake for a considerable distance the banks of the valley are far apart, and except at one point about a mile and a half below the outlet of the lake, do not offer a site for control. At this point there is a possible site for a dam, but the fall of the stream is so rapid that at the extreme height of the dam only about 2 feet of storage would be obtainable on the lake, and the structure involved would be six or seven hundred feet long on the crest.

After careful consideration of the physical peculiarities of the locality, it was not thought that a detail survey of the different points in the vicinity was justified, and the possibility of storage at this point was therefore not further considered.

Kananaskis River.

The Kananaskis river has a drainage area of 406 square miles between the lakes and the Bow river. It flows through a narrow valley confined by high mountains—the Kananaskis range forming the west boundary, and the Opal range the east. The tributaries are all small and on account of the topography are mountain torrents, being short and steep and carry down large quantities of gravel and detritus. The valley bottom through which the river flows is, on the whole, wide and flat. Where this is not the case, the river flows between alternating high rocky cliff and gravel and clay banks, the latter being moraines composed of the material transported by the mountain torrents and ancient glaciers. The valley floor is deeply covered with this transported material, through which the river has cut its way and, where the valley is wide and flat, the river is continually changing its course, especially during the high-water season. At one point about 4 miles below the Lower lake, a fall about 25 feet high occurs; for the rest of its length, no abrupt drops occur, but the fall is considerable.

Storage Possibilities.

One scheme which has been put forward for the storage of water from the Kananaskis river. From a point south of the Indian reserve, the water was to be conveyed across the summit by canal or flume into lake Chiniki on the Indian reserve; this would involve a dam in the river at a point about 2 miles south of the mouth of the first creek which flows into the river from the east, and south of the Indian reserve (the only important creek in some miles).

It would be necessary to build a structure about 50 feet high in order that the water might be raised over the low summit between the lake and the river, and a flume about half a mile long would be necessary to carry the water across the low valley of the creek mentioned above. At the lower end of the lake, a structure approximately 4,000 feet long would be required to maintain the water at the necessary level so that it could be returned to the river when required at the Kananaskis falls and Horseshoe falls on the Bow river.

The elevation of the river at the point where a dam would be necessary is 200 feet above the water level under the Canadian Pacific Railway bridge or elevation 4,328; lake Chiniki level reduced to the same elevation is 4,300, the summit referred to between the lake and river is long and flat, rising to an elevation of 4,370, precluding the possibility of a canal through in place of going over.

A careful survey of the river has revealed the fact that there are several sites where small storage basins may be developed. They must, however, be considered mainly as regulating basins, being used for the creation of auxiliary power and providing small amounts of water to carry the peak loads on the plants on the Bow river below the junction of the Kananaskis and Bow rivers. The sites of this description are three in number, as follows:—

Upper Site, No. 1.—The upper site situated about 9 miles upstream from the mouth of the river at a point where two spurs of the mountains approach one another, producing a short canyon through which the river flows. The valley

Photo by M. C. Hendry.

Upper Kananaskis Lake.

above this canyon is wide and provides for considerable storage at this point. (See reproduction page 122.) Surveys were made in more detail by the Calgary Power Company and the figures in relation to the size of the structures and capacity of the basins are quoted from the report by their engineers. The length of river flooded would be approximately 12,000 feet. The size of the structure involved is as follows:—

Height of dam	110	feet.
Length on crest	1,250	"
Depth of water	100	"
Average head (for power purposes)	70	"
Capacity of basin	14,900	acre-feet.
Estimated cost	$304,000	

Photo by M. C. Hendry.

Lower Kananaskis Lake.

Central Site, No. 2.—The middle site lies about 6 miles upstream from the mouth of the river. The site of the dam is in a narrow rock canyon (see reproduction page 123), the walls of which rise abruptly to a height of about 100 feet above the level of the river.

The flooded length of the river at this site would be approximately 9,500 feet. The size of the dam involved is as follows:—

Length on the crest	1,000	feet.
Height of water	100	"
Height of dam	110	"
Average head (for power purposes)	70	"
Capacity of basin	10,750	acre-feet.
Estimated cost	$213,000	

Lower Site, No. 3.—The lower site is the one of particular interest. It lies about three-quarters of a mile above the mouth of the river, at which point the water is raised about 12 feet by the Kananaskis Falls plant. That is, the impounding structure is actually situated in the pond of the plant below

so that any water released from storage is at once available for producing power at the plant. In addition it is proposed to install equipment at the storage dam capable of an output of 1,000 horse-power.

The size and capacity of the structure is as follows:—

Length of flooded river	8,000 feet.
Length of dam on crest	670 "
Height of dam	85 "
Depth of water	80 "
Average head (for power purposes)	45 "
Capacity of basin	8,040 acre-feet.
Estimated cost	$150,000.00

Water Supply.

The stream has been gauged since September, 1911. The latest records available are for the year 1912. Those of November and December, 1911, are not complete, so the records for 1912 are used. The mean monthly flows and also the maximum and minimum flows are as follows:—

Discharge Kananaskis River.

Month.	Maximum.	Minimum.	Mean.
	c.f.s.	c.f.s.	c.f.s.
January	160	123	136
February	132	118	129
March	132	113	129
April	149	108	128
May	866	120	477
June	3,006	478	1,582
July	3,258	1,262	1,996
August	3,222	1,014	1,424
September	898	424	653
October	414	314	376
November	314	120	252
December	440	72	204

These discharges are only for one year so are not truly representative, but must be used as a basis to work out the benefits of creating a storage and regulating basin.

Effect of Storage.

Two tables have been prepared showing the effect of the storage allowing for a continuous discharge through the basin and in addition a discharge which will help to carry the peak loads upon the plants situated upon the Bow river.

Table No. 14 is based upon certain assumptions made by Mr. H. S. Johnston, of the Calgary Power Company, in his preliminary report on auxiliary storage on the Kananaskis river.

A continuous flow of 140 c.f.s. has been provided for, and in addition to this a discharge of 81 c.f.s. for eight hours each day, it being assumed that that length of time would cover the peak-load hours. Under these conditions the storage would be exhausted by May 1, that is, there would be no power derived from the continuous discharge through the dam or from the additional intermittent discharge owing to the head being eliminated.

TABLE No. 14.

STORAGE BASIN 8,040 ACRE-FEET, ALLOWING FOR 140 SECOND-FEET CONTINUOUS FLOW; ALSO A FLOW OF 81 SECOND-FEET FOR EIGHT HOURS PER DAY.

Month.	Mean Flow.	Continuous Flow.	Intermittent Flow Ac.-ft. in 8 hours per day.	Surplus Flow Ac.-ft.	Deficit Flow Ac.-ft.	Quantity in Basin Ac.-ft.	Remarks.
November	252	140	1,605·	5,055·	.....	8,040·	Basin full.
December	204	140	1,658·5	2,831·7	.....	8,040·	"
January	136	140	1,658·5	.....	1,880·6	6,159·4	Basin drawn on.
February	129	140	1,488·	.....	2,098·7	4,060·7	" "
March	129	140	1,658·5	.....	2,269·2	1,791·5	" "
April	128	140	1,605·	.....	2,198·	.....	Basin empty.
May	477	140					

TABLE No. 15.

STORAGE BASIN 8,040 ACRE-FEET, ALLOWING 130 SECOND-FEET CONTINUOUS FLOW; ALSO ALLOWING 80 SECOND-FEET FLOW EOR EIGHT HOURS PER DAY.

Month.	Mean Flow	Continuous Flow	Intermittent Flow Ac.-ft. 8 hours per day.	Surplus Flow Ac.-ft.	Deficit Flow Ac.-ft.	Quantity in Basin Ac.-ft.	Remarks.
November	252	130	1,586·4	6,262·6	.....	8,010·	Basin full.
December	204	130	1,639·	2,763·2	.....	8,040·	"
January	136	130	1,639·	.....	1,270·	6,770·	Basin drawn on.
February	129	130	1,480·6	.....	1,536·	5,234·	" "
March	129	130	1,639·	.....	1,700·5	3,534·5	" "
April	128	130	1,586·4	.....	1,709·5	1,825·0	" "
May	477	130					

FIRST ASSUMPTION.

The only benefit obtained during the last month of storage being that due to the effect of the eight-hour discharge upon the plants below. The continuous discharge cannot be included since it represents the natural flow of the river and would be utilized under ordinary conditions. This effect may be stated as follows:—

During the first five months of storage the average head at the storage dam may be taken as 45 feet, giving a continuous output of 572 b.h.p. due to a discharge of 140 c.f.s. In addition to this there will be an output for eight hours each day of 330 b.h.p., due to a discharge of 81 c.f.s.

The effect of releasing 81 second-feet from the basin would be to make it at once available for power production at the three points below the basin at Kananaskis falls, Horseshoe falls and the Bow Fort site since the tail-water of one plant is nearly at the same elevation as the head-water of the plant next below.

The effect upon the fourth site would not be noticed for at least two hours after water was released, as there is a stretch of about 8 miles of river between the tail-water of the Bow Fort site and the Mission site; at the next two sites, Ghost and Radnor, the effect would be noticed about the same time or approximately two hours and a half after water was released. If the power from

these plants could be sold so that the peaks could lag behind the peaks on the plants above from two to two-and-a-half hours the water could be utilized, otherwise no benefit would be realized. Assuming that such an arrangement could be consummated, the peak loads on the different plants could be increased by releasing water from the auxiliary storage to the following extent:—

TABLE No. 16.

EFFECT OF KANANASKIS AUXILIARY STORAGE.

Plant.	Head.	Peak Load Power.
		b.h.p.
Kananaskis Falls	70	515
Horseshoe Falls	70	515
Bow Fort	66	490
Mission Site	47	350
Ghost Site	50	370
Radnor Site	44	325
Total on 6 plants		2,565

In addition, there is the continuous output for five months at the storage dam of 572 b.h.p. due to 140 c.f.s. flow; also the peak output of 330 b.h.p., or a total peak output, due to 81 c.f.s. on all the plants, of 2,895 b.h.p. for five months. For the whole period the peak load output would be increased by 2,565 b.h.p.

SECOND ASSUMPTION.

TABLE No. 15 provides for a continuous flow of 130 second-feet, which corresponds nearly to the mean low-water discharge of the river, also an intermittent discharge of 80 c.f.s. for eight hours per day. Under this arrangement there is in the basin at the end of the season 1,825 acre-feet, or an average head of 45 feet can be maintained at the dam throughout the low-water season.

Under the same assumptions as to distribution of peak loads as before we obtain the following:—

TABLE No. 17.

EFFECT OF KANANASKIS AUXILIARY STORAGE.

Plant.	Head.	Peak Load Power.
		b.h.p.
Kananaskis Falls	70	510
Horseshoe Falls	70	510
Bow Fort Site	66	480
Mission Site	47	342
Ghost Site	50	363
Radnor Site	44	320
Storage Site	45	327
Total: Peak load output from storage		2,852

Or, comparing the two methods on the basis of horse-power hours, the auxiliary output on peak load by the first method of regulation would be 4,623,120 horse-power hours.

By the second method of regulation the output on peak load from auxiliary storage would be 4,700,096 horse-power hours.

By the first method the continuous output of power would be reduced by 907,200 horse-power hours and by the second increased about one-half of that amount, or 383,000 horse-power hours. If the peak loads are high, then the second method of regulation would be the most advantageous. If the load is nearly uniform, then the reverse is the case.

No definite conclusions can be drawn with regard to the economic side of the question without knowing the load conditions on the plants. An attempt has been made, however, to arrive at the probable cost of the power produced by the use of this basin. The cost deduced is in terms of kilowatt hours, to conform to the other costs in this report.

Photo by M. C. Hendry.
Kananaskis River—Looking South from shoulder of Mt. McDougall.

Capital Cost.

The estimated cost of creating this storage also building and equipping the auxiliary plant is, approximately, $150,000.

Annual Charges.

Taking the capital cost at $150,000, the probable annual cost of maintaining and operating the plant would be:—

1. Interest on capital invested assuming financing done on bonds at 6 per cent, sold at par	$9,000·00
2. Sinking fund to return bonds in 30 years, reinvested at 4 per cent, say $1\frac{3}{4}$ per cent	2,625·00
3. Depreciation, adjusted between general works and equipment, to provide for major repairs and renewals	2,250·00
4. Operation and maintenance, including management, superintendence, wages, minor repairs, etc	3,375·00
Total annual charges	$17,250·00

Assuming that the output of the plant is continuous the year round, that is, to the capacity of the plant for six months and for the remainder of the year, having an output due to the continuous flow of 130 second-feet, plus the peak load discharge; then the output would be 6,078,840 k.w. hours; to this may be added the peak output on the plants below due to this auxiliary storage, that is, 2,726,584 k.w. hours.

Photo by M. C. Hendry.
Kananaskis River—Looking North from shoulder of Mt. McDougall.

Cost of Power.

That is the total output from storage is 8,805,400 k.w. hours.

On this basis, assuming the annual charges at $17,250, the cost per k.w. hour would be 0·20 cents.

Owing to the possibility that some time may elapse before the three lower plants are built, the following costs have been arrived at, basing the output on the auxiliary plant and the three plants at Kananaskis falls, Horseshoe falls and Bow Fort site.

As before, the capital cost of the undertaking would be $150,000 and the probable annual charges $17,250. With the same assumptions as before, a capacity load on the auxiliary plant for six months and the remaining six months a load carried by the discharge of 130 c.f.s., plus the load carried by the discharge of 80 c.f.s. per day, and added to this the peak load on the upper three plants carried by the discharge of 80 c.f.s. from storage. The output of power from the storage created would be:—

From auxiliary	plant.....	6,078,840	k.w.	hours	per	year.	
" Kananaskis	"	550,906	"	"	"	"	
" Horseshoe Falls	"	550,906	"	"	"	"	
" Bow Fort Site	"	518,499	"	"	"	"	
Total.....		7,699,151	k.w.	hours	per	year.	

With an annual cost of $17,250 the cost would be 0·22 cents per k.w. hour.

HECTOR LAKE.

In July, 1911, a reconnaissance was made of the upper part of the Bow river, to determine the possibilities of storage in that section of the river. The expectation was that either or both the lakes, Hector and Bow, forming the source of the Bow river, might be utilized. Bow lake at the source was proved to be suitable, and is dealt with in another part of the report; on the other hand, Hector lake was found to be unsuitable for storage purposes. (See reproduction page 127).

Hector lake lies in a hollow formed between a number of high peaks; to the west lie mounts Gordon, Balfour and Olive, of altitudes 10,336, 10,731 and 10,260 feet, respectively, all glacier-hung peaks. To the south is Pulpit peak, of an elevation 6,930, and to the north lies Bow peak.

Hector lake is fed from the glaciers to the west, and also from two small lakes to the south that lie at high altitudes—the upper one, Turquoise lake, at an elevation of 5,975 feet, and Margaret lake at an elevation of 5,926; the upper lake empties into the lower, and this in turn into Hector lake; to the north is a stream coming down on the south side of Bow peak.

The lake is about $3\frac{1}{4}$ miles long, and three-quarters of a mile wide, it lies about 15 miles by the river above Laggan and at an elevation of 5,700 feet above sea-level, or upwards of 600 feet higher than Laggan. The lake is to the west of the river, about three-quarters of a mile, and is connected with it by two streams which form the outlet; the intervening land had the appearance of having been deposited there in past ages by the river in the form of a bar. Apparently the lake at one time formed a great enlargement of the river and was probably, at the same time, to a great extent covered by the ice from the glacier to the west. This glacier is known as Balfour glacier and is formed by the immense snow fields which cap the summit of the main divide at this point, and which also feed the Bow glacier. As the glacier receded, the bed of the present lake was left, the east end being separated from the river by the material deposited, as has been said.

This barrier, as it may be called, is about three-quarters of a mile wide, and about the same length, parallel to the river, rising to an elevation of several feet above the level of the lake, and any structure to impound water in the lake would have to be of great length in order to raise the lake level any considerable height; the material is loose and in places very swampy. The lake could not be considered, therefore, as a storage basin either from the engineering or economic standpoint.

PIPESTONE CREEK.

The Pipestone creek is one of the largest tributaries of the Bow river, entering above Banff. It has a drainage area of about 160 square miles, which is comparable with that of the main river above their junction, their confluence is about half a mile below Laggan station on the Canadian Pacific railway.

Discharge.

At the junction point with the main river a gauging station has been established at the instance of the Water Power Branch.

The discharge of the Pipestone, as measured at the entrance of the Bow, forms a considerable portion of the discharge of the Bow at that point. From records available the discharge of the Pipestone may be taken as forming one-third of the discharge of the Bow below their junction during high water; during the normal period the proportion is greater; while at the low-water period, it forms nearly one-half of the total discharge.

The records extend over only a very brief period (since September, 1911), so that no definite conclusion can be drawn as to the relative discharges of the two streams, but the available records are, however, included and may prove of interest.

Drainage Area.

The drainage area of the Pipestone is very similar in character to that of the Bow above Laggan, the same mountains forming a considerable proportion of the drainage area of each. Their sources lie at considerable altitude, the great difference between the two being that while the Bow has two lakes as its source the Pipestone has no lake to act as a regulator of run-off. Strangely enough, this difference has apparently the opposite effect to that to be expected, for the variation between high and low water on the Pipestone is, from the records available, apparently less than upon the Bow.

The Pipestone from source to mouth is about 22 miles long. It rises at an altitude of 8,364, and is fed by numerous small streams coming down the mountains, such as Molar creek from mount Molar and from Cataract peak. The descent of this creek is very rapid, reaching an altitude at the junction with the Little Pipestone of 5,860, a fall of 2,500 feet in about 11 miles, or 257 feet per mile. For the next 6 miles the fall is 360 feet, or 60 feet per mile, and for the remainder of its length, about 110 feet per mile. The largest creek entering the Pipestone is that known as the Little Pipestone, which enters from the east, and is about 8 miles long, having as its source several small lakes, which lie at between 6,500 and 7,000 feet above sea-level. It drains the northern slope of mounts Richardson and Ptarmigan, which are both over 10,000 feet high and glacier hung.

Possibility of Storage.

A reconnaissance of the Pipestone with a view to storage was made in July, 1912, and at the same time the head-waters of Corral creek and Baker creek were examined.

On the Pipestone it was found that for the first few miles the river was very rapid, the fall of 110 feet per mile being exceeded in places. The stream is confined to a comparatively narrow valley by high steep banks of what might be termed glacial drift, which overlies the rock to a considerable depth; this, in conjunction with the rapidity of fall, is not favourable for the storage of any considerable volume—such as would warrant construction. Higher up, the valley widens into a large flat, which on examination showed that no suitable site for a dam offered itself, and that the slope of the valley was so great that in any event a high structure would be required to flood the valley for any distance upstream.

Above the junction of the Little Pipestone the character of the valley changes, becoming narrower and much steeper; after careful examination it proved as disappointing as the lower portion of the river, and in consequence the only possible conclusion was that storage on the Pipestone is not possible, and no further work upon it was warranted.

BAKER CREEK.

At the same time as the reconnaissance of Pipestone creek the trip was made to include Baker creek, which is the next important stream to enter the Bow below Laggan.

Drainage Area.

This creek enters the Bow from the north about 8 miles from the mouth of the Pipestone; it is about 15 miles long and has a drainage area of 52.8 square miles, about one-third the area of the Pipestone drainage basin. Unlike the

Pipestone, it has two lakes at the source of the main branch, whilst another lake forms the source of the second branch; these lakes are among the highest in the country, the lower of the two first—Baker lake—being at an elevation 7,230 feet above sea-level, and the higher—Ptarmigan lake—at an elevation of 7,561 feet; and lake Redoubt, which forms the source of one of the branches, is the highest, at an elevation of 8,000 feet. The elevation at the mouth of the river is 4,859, so it will be seen that the fall is very rapid; from Ptarmigan lake to Baker lake the fall is 331 feet in less than a mile, and from Baker lake to the mouth of that river the fall is 2,371 feet, being 1,230 feet in the first 3 miles below Baker lake, or 410 feet per mile, and from there to the mouth the fall averages 142 feet per mile.

Discharge.

The discharge of Baker creek has not been measured systematically, no gauging station has been established upon it and any records of its discharge that may exist are not available. An estimate of the discharge might be made from a comparison of the size of the drainage area and a study on the ground of the Pipestone and Baker creeks, assuming a run-off one-half that of the Pipestone. The existence of three lakes at the source of Baker creek would be expected to have some influence upon the regulation of the flow, but this regulation cannot be very marked on account of the formation of the outlets of the lakes.

Storage Possibilities.

After a study of the maps, and a consideration of the evidence gathered from men familiar with the country as to the physical features of the valley of Baker creek, it was considered that any possibility of storage lay in one or all of the lakes which were to be found at the head of the creek and that any study should be made at the upper part; this was done.

Baker lake was the first one visited. As before stated, it lies in a rocky basin at an elevation of 7,230, is about three-quarters of a mile long from east to west, and about one-fifth of a mile wide. On the north side the shoulder of Fossil mountain slopes down to the water's edge, while to the south is Fallen mountain. The lake is confined in its bed by a long, low rock ridge, which extends across the east or outlet end, this ridge is very low, rising only a few feet above the lake level for the greater part of its length, and falling away very rapidly on the downstream side. The situation is not favourable for storage, the area that might be developed by a structure at the lower end being small, and, owing to the topography, any structure would be of great length. (See reproduction, page 128.)

The upper, or Ptarmigan lake, about a mile to the west, is somewhat smaller than Baker lake, into which it empties, and is very similarly situated. From the outlet, the descent is very rapid, falling in a series of cascades; the outlet is over a low ridge, and presents the same difficulties to storage as does Baker lake.

Redoubt lake lies to the south of the west end of Ptarmigan lake, and as has been pointed out, is about 500 feet higher. The waters from Redoubt lake do not enter Baker creek through Ptarmigan and Baker lakes, but through a valley extending to the east from the shore of the lake. The descent of this creek is extremely rapid, it is less than 3 miles in length, yet in that distance it has a total fall of over 2,100 feet, from three to five hundred feet of this fall occurs at, or near, the outlet, and in this respect the lake is the most peculiar of the three. This lake is situated on a shelf of rock, on the shoulder of mount Redoubt, and on account of its situation (resembling a saucer upon a shelf) very little variation in level can occur. A rise of less than 2 feet

would give a spillway of at least 300 feet in length, while any reduction below that level prevents run-off, as apparently the only outlet is over the ridge rock. This peculiarity, taken in conjunction with its size, about one-half-a-mile by one eighth of a mile, places it out of the question for storage.

In addition to the physical features of the lakes, their extreme altitude militates their use as storage basins unless they could be utilized during the early fall to augment the flow; in the spring they would be useless, because by the time their waters, stored from the previous year, were available, the floods would have set in and discharge from storage would be unnecessary.

The idea of using the lakes and Baker creek for storage purposes had therefore to be abandoned.

JOHNSON CREEK.

Johnson creek, a stream of considerable size entering from the north, adds its waters to the Bow river about 3½ miles below Castle station on the Canadian Pacific railway. It is about the same length as Baker creek. The head-waters are at considerable altitude, one branch rising at 8,000 feet, and the area drained is 49 square miles. The mountains to be found in the basin, however, are not generally so high as those to be found in the Baker basin; in the matter of glaciers, too, it resembles Baker creek, there being none in either area. Given, then, the same general characteristics in the matter of altitude, area, etc., the run-off should be expected to be nearly the same, their drainage areas being so close to one another. In the matter of lakes, the resemblance is not so marked, only one occurring on Johnson creek.

For the upper 6 miles of the creek, the fall is 2,000 feet, or 333 feet per mile, below this the fall averages about 170 feet per mile down to the mouth, the total fall being 3,367 feet. About 8 miles from the mouth a small lake empties its waters into the main creek; this lake is about one-quarter of a mile to the west and almost 500 feet above the bed of the stream.

Photo by M. C. Hendry.

Hector Lake—Looking towards outlet.

Discharge.

No data are available regarding the discharge of Johnson creek, though it is understood that some isolated gaugings were made of the creek during the last season, it might, however, be assumed that it would bear the same relation to the discharge of the Pipestone as Baker creek does, approximately one-half to one-third that of the former stream might be a fair estimate.

Photo by M. C. Hendry.

Ptarmigan Lake.

Storage Possibilities.

In August, 1912, an investigation of this creek was made, in order to determine whether storage of any extent might be developed upon it. It was known that a deep and narrow canyon existed where the stream made its exit between the shoulder of Castle mountain and the Sawback range (see reproduction, page 131), and that a valley of some considerable extent lay at the upper end of the canyon. An examination proved this to be so. Access to the valley is gained by means of a trail which leads up the west side of the creek, and lies well up on the outlying shoulder of Castle mountain. On account of the depth and narrowness of the canyon, the trail swings up, as the latter is neared, then following parallel to it, it finally turns abruptly down until it strikes the rim of the canyon proper, along which it lies for nearly one-half mile until the latter widens out when the trail drops down into the valley so formed. This canyon is the deepest encountered in the area covered by the investigations, it is approximately three-quarters of a mile long, and at one point must be from 600 to 700 feet deep and at the top not over that in width at the narrowest point; the accompanying reproductions illustrate the nature of this canyon fairly well. The valley behind the canyon is rather limited in extent, and does not widen out suddenly at the mouth of the canyon, but extends for nearly one-quarter of a mile before the widest point is reached where it is not over one-third of a mile wide. The valley floor is narrow, rising in a series of benches on either side; it is about one mile long, and then

narrows, the stream having banks from ten to twenty feet high, back of which are a series of terraces. As was shown earlier, the valley slope is very steep, especially where the stream enters the canyon, and in order to flood the valley even for one mile upstream a structure at least 200 feet in height would be required; this in the light of the restricted area that would be flooded would involve a cost that could not be considered.

VERMILION AND REDEARTH CREEKS.

These two creeks enter the Bow river from the south, Vermilion about 1 mile west of Castle, where the new motor road, which will eventually cross the Rockies, crosses the Bow river from the north to the south side. The Redearth enters about 5½ miles below the Vermilion, and from the same side.

Both these creeks are very short and their slopes abrupt, the former falls 1,550 feet in 7 miles, or 220 feet per mile, and the latter averages 200 feet per mile.

A careful inquiry was made into the natural conditions and considerable information gathered from men thoroughly familiar with the country. Owing to the inaccessibility of the streams, especially Redearth, it was not considered that an examination was necessary, the conclusion being reached that they were not adapted to storage.

BREWSTER CREEK.

The waters of Brewster creek and Healey creek combined enter the Bow river about 3½ miles west of Banff; the flow is of fair magnitude, though no gauging has been made of the stream.

Just above the mouth where it issues into the bottom of Bow valley, it spreads itself over a gravel flat and is divided into a number of small streams, each of which finds its way to the main river, and on this account cannot have any marked effect upon the winter flow of that river. Brewster creek, like all the other creeks that have been examined, has an excessive slope from source to mouth; it is not as steep, however, as the others, having an average fall of 100 feet per mile.

Drainage Area.

The drainage area is 92 square miles, rather larger than that of Baker creek. There are three main branches, all of which rise on the northeastern slope of the main divide, the chief of these rises in the mountains lying between the Spray river and mount Assiniboine, Fatigue creek, fed from the slopes of the mountain of the same name, and Douglas, west of Fatigue creek; Healey creek lies farther to the west, near the summit of Simpson pass.

Above the junction of Healey creek and Brewster creek, and on the main stream, occurs the only possible site suitable for a storage dam. This is a canyon of about 70 to 80 feet wide, and 60 to 70 feet deep. In passing through it, the course of the stream is similar to the letter "S," the point suitable for the dam being midway between the two loops. The canyon is only a few hundred feet long; above it the valley opens out and in places is about 1 mile wide. The stream flows very rapidly, however, and the slope is steep at this point, the immediate utilization of the dam is therefore unlikely.

Examination of the creek did not reveal any other suitable dam site with a sufficient storage area behind it.

These examinations exhausted the possible sites for storage in the mountains on streams tributary to the Bow.

GHOST RIVER.

The Ghost river, which enters the Bow on the north side at a point about 35 miles west of Calgary, is 40 miles long from source to mouth, and has a drainage area of 367 square miles. Eight miles from the mouth, the stream divides into two branches, known as the Main branch and the North Fork. At a point 7 miles farther the main stream divides again, one branch retaining the name Ghost river, and the other being known as the South Fork.

The sources of these three branches are at about the same altitude, 8,000 feet above the sea-level. The South Fork rises on the east slope of the Fairholm range, and issues through the gap formed by End mountain and Saddle peak into the foot-hill country, and in a distance of 8 miles falls 2,000 feet, or 250 feet per mile. The main branch of the Ghost rises on the north side of the Palliser range, of which Cascade mountain is the easterly end, it flows around to the north of mount Aylmer, to the south side of Devil's Head, and out into the foot-hills. The fall of this part of the Main branch is not as steep as that of the South Fork, being approximately 133 feet per mile; the valley through which it flows is wide, and covered with gravel and the debris carried down by the mountain torrents which are tributary to it. The North Fork rises on the eastern slope of Castle Rock; it has a less steep slope than the others, and is for the most part in the foot-hills; it has numerous tributaries, which rise in the swamps and sloughs to be found in the territory through which it flows.

Discharge.

Discharge records of the Ghost river have been kept since August, 1911. The gauging station, which was established at the instance of the Water Power Branch, is at the highway bridge which crosses the river about 200 yards from the mouth, and the gauge rod is placed about 1 mile upstream. The available records cover only one year, the readings were unfortunately interrupted for a period during November and December, no data being available for a month during the low-water; good records were obtained, however, for January, February, March and April. The mean flow for that part of November available shows a flow of 219 c.f.s., with 191 c.f.s. as the minimum, so that it may be assumed that a flow of approximately 100 c.f.s. is available during the period of low-water. The available records of run-off will be found elsewhere in the report.

The greater part of the area drained by the Ghost river lies in the foot-hills; it is reasonable to expect, therefore, that the discharge will be more susceptible to the direct influence of rain and snowfall. An examination of the data reveals the fact that the flood period is earlier than on the other streams, making its appearance in April and May, and that the precipitation during the fall, instead of being stored as it would be in the higher altitudes, is apparently discharged to a great extent at once, or being at a lower altitude is melted and runs off. The run-off during September and October is comparable to that of May and June, while from the records the run-off during August appears to be even greater.

Storage Possibilities.

The slope of the stream is so steep in the mountain portion that the development of any storage in that section was at once discarded as improbable, and attention was given to the section to be found in the foot-hills. The South Fork and the Main branch both, particularly the portion between the junction with the South Fork and the junction with the North Fork, flow through valleys that are comparatively wide, varying from a couple of hundred to a thousand feet in width. During low and normal periods, the river spreads all over the

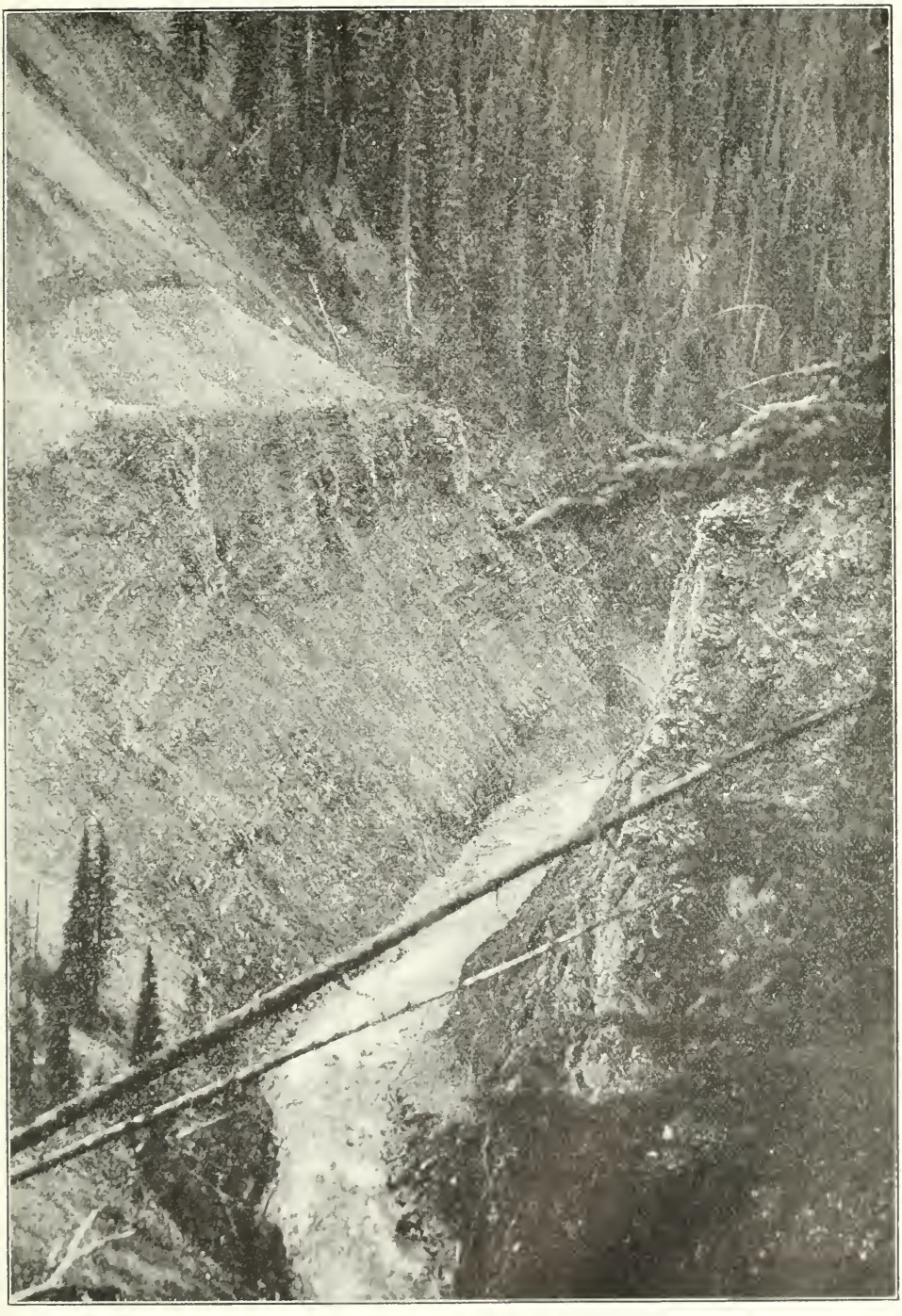


Photo by M. C. Hendry.

Johnstons Creek Canyon.

valley; in many places the river is split up into a number of small streams, which flow all over the gravel bed of the river. The whole floor of the valley is covered to a considerable depth with the gravel and detritus carried down by the river during high water, at which time the river covers the whole valley. (See reproduction, page 12).

The banks are for the most part high, rising from 50 to between 100 and 200 feet, the rise for the first hundred feet being rather abrupt, after which it is more gradual. In the part between the two banks very little bottom land exists, the river occupying the whole of the valley bottom. The south side of the valley is mostly formed of rocky cliffs, overlaid with gravel and glacial drift, and affording very few points of access to the river valley, from the north side the river may be reached in many places. The first point encountered where storage might be developed, was just west of the junction of the Main branch and the North Fork; here the banks of the valley approach each other, and the river flows through a narrow canyon, the south bank of which rises to a considerable height, but the north does not rise more than 50 feet above the water level. The rock forms a cliff on either side and extends across the river forming a bar, on the upstream side a considerable quantity of gravel has been deposited, the water drops about 2 feet in 50 at this point, a drop of nearly a foot occurring where it passes over the bar. The limiting feature of any storage scheme at this point is the height of the rock on the north side; approximately 45 feet above the present water level would be the limiting height to which the water could be raised. Considerable fall in the water level exists at the entrance to this canyon, so that 40 feet would probably be the depth that could be obtained in the valley at the mouth, and the rise in the river would not admit of backing the water up for more than a mile, with a structure of this height. The storage provided under these circumstances would be of little use from a power standpoint, except as an auxiliary storage to take care of fluctuations due to changes of temperature. Any storage created on the Ghost would only affect the plants below the junction with the Bow, and these would be benefited within a few hours of the release of the water from the storage.

As the necessity for such storage is somewhat remote, nothing more than a reconnaissance was made of the site. A detail survey might prove the scheme to be out of the question.

On the North Fork, the Eau Claire Lumber Company have built a small timber dam near section 29, township 27, range 7, to store water for driving purposes when the river is low, but just how large this storage is, is not known. It is also understood that they are contemplating changing the site for one higher up stream where more water may be impounded. It is not likely that these basins will store any large amount of water; besides which, they are rather remote for close regulation. It is understood that the basin now used may be filled in a few hours when the flow is normal.

Below the junction of the North Fork with the Main river, the valley is not nearly so wide as above, the banks are steeper, especially on the south side. From a point in section 5, township 27, range 6, to the mouth of the river, the river winds from side to side on the valley and the banks alternate as high rocky cliffs and steep gravel banks, and the valley becomes deeper and narrower as the mouth is approached; the slope of the river for the last 5 miles from the mouth averaging a little under 40 feet per mile.

Regulation Storage Basin.

Two miles from the mouth, the river passes through a narrow gap in the rock formation, the banks are nearly 300 feet high, while the width at water level is not more than 125 feet, and at an elevation of 80 feet above water level the width is only 200 feet. While working on the Bow river the work of necessity

extended nearly to this point, and a very rapid plane-table survey of the river valley upstream for a distance of 3 miles was made and tied into the Bow river work. This survey has not developed anything attractive, but it illustrates the nature of this stretch of the Ghost river. Rough computations were made of the storage capacity at this point, based upon different-sized structures, and even with a structure 100 feet high the amount of water impounded is only 4,300 acre-feet, while the cost of securing this places it out of the question.

From the foregoing it will be seen that storage upon the Ghost is not a very attractive proposition, though it might be considered advisable at some future time to create a basin capable of storing say 4,000 acre-feet for purposes of close regulation of power plants on the Bow (say at the mouth of the Ghost, and at Radnor), similar to that proposed for the Kananaskis river; any greater storage on the Ghost could not be considered.

CHAPTER XI.

BENEFITS OF STORAGE.

GENERAL.

In the foregoing part of this report, the estimates of the capacities of the different reservoirs based upon the surveys made and run-off data available have been given. Also they are considered to be an economical development of each basin, and are briefly as follows:—

TABLE No. 18.

CAPACITY OF STORAGE BASINS.

Basin.	Capacity.
	Acre-feet.
Spray Lakes basin	171,000
Lake Minnewanka between elevations 4728–4740	44,700
Lake Minnewanka between elevations 4724–4740	58,900
Bow lake between elevations 6400–6430	27,400
Elbow river (Approx.)	23,000
Total storage capacity (Minnewanka 12 feet)	266,100
Total storage capacity (Minnewanka 16 feet)	280,300

The estimated costs of creating the different basins have been given, but are here recapitulated.

TABLE No. 19.

COST OF STORAGE.

Basin.	Quantity of storage. Acre-feet.	Cost.	Per Cost Acre-foot.
Bow lake	27,400	$105,000	$3·88
Spray lake	171,000	514,000	3·00
Minnewanka	44,700	140,000	3·00 (approx.)
Elbow	23,000	190,000	8·30

The cost of creating these storage basins with the exception of that on the Elbow, compare favourably with similar work in other places. For comparison purposes the following table, taken from a report by J. D. Schuyler, is included, giving the capacity of basin, cost of creating storage and type of structure:—

BOW RIVER
AT
HORSESHOE FALLS

Diagram shewing Discharge in Acre-Feet, from May 1909 to Feb. 1913
— ALSO —
Effect of Spray Lake Storage over low water periods

To accompany report on Power and Storage Investigation,
by M C Hendry, B A Sc

Consulting Engineer
M. C. Hendry Chief Engineer

SPRAY LAKE STORAGE BASIN
Storage Capacity, 171,000 Ac-ft
Storage Available 160,000 Ac ft

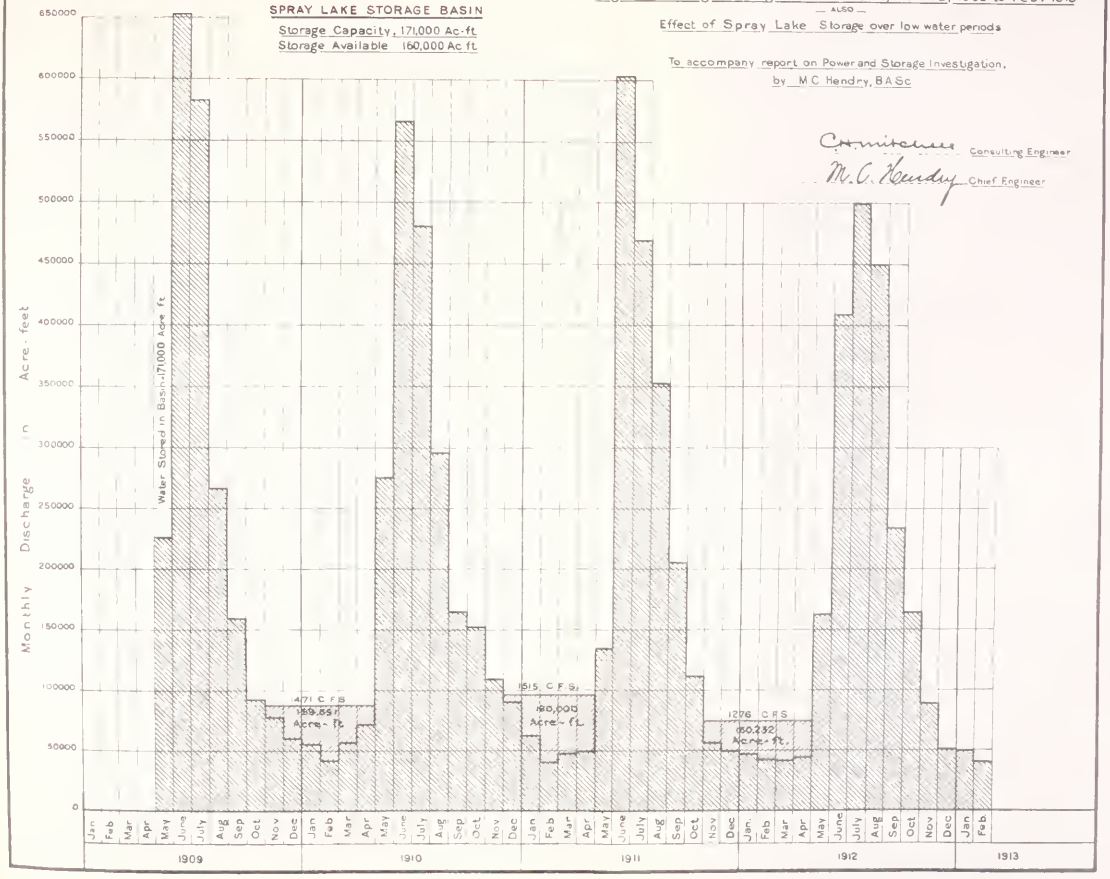


TABLE No. 20.

STORAGE BASINS.

ne.	Location.	Character of structure.	Total cost.	Storage capacity in million cu. ft.	Cost per ac.-ft.
Belle Fourche dam	S.D.	Earth	$897,164	9,360	$4·16
Buena Vista lake	Cal.	"	150,000	7,400	0·88
Laramie R. Dam	Wy.	"	117,200	5,230	0·98
Bear Valley Dam	Cal.	Masonry	68,000	1,740	1·70
Windsor	Cal.	Earth	75,000	1,000	3·27
Sweetwater	Cal.	Masonry	264,500	980	11·76
Eureka Lake	Cal.	Rock-fill	35,000	660	2·31
Hemet	Cal.	Masonry	150,000	460	14·20
Tyler	Texas.	Hydraulic-fill	1,140	77	0·64
La Mesa	Cal.	Hydraulic-fill	17,000	57	13·09
Yuba	Cal.	Hydraulic-fill	38,000	51	32·46

The comparison of costs is comparatively favourable to the Bow river storage; the ultimate basis upon which the whole project must be judged, however, is the actual benefit to be reaped by the power producers upon the part of the river affected by storage, and the increased amount of power which may be produced at the undeveloped sites.

REVIEW OF SITUATION.

Before going into these benefits, the general question of storage will be reviewed. As has been emphasized before, the lack of continuous records of run-off over any considerable period renders positive conclusions impossible, but it is considered that those reached, regarding discharge under low-water conditions, are reasonably correct. After a careful investigation and a study of the run-off and meteorological data available, together with a knowledge of the physical conditions obtaining throughout the year, it has been found that the mean monthly flow at Horseshoe falls during the period recorded does not fall below 720 c.f.s.; during short periods, perhaps a single day, the flow has dropped below 600 c.f.s.; but the mean monthly flow upon which the storage scheme must be worked out is as above. The lowest average mean monthly flow for the period 1909-12 was 833 c.f.s, and occurred in the low-water season 1911-12. The benefits to be derived from storage has been worked out upon the basis of mean monthly flow, and what is felt to be a fair allowance has been made for loss due to evaporation and wastage between the point of storage and the point of utilization.

DIAGRAMS

Diagrams have been prepared showing the effect of storage upon the flow at Horseshoe falls. The effect of storage from Minnewanka lake, for the low-water period 1909-13, may be seen on the diagram, Plate No. 9; the effect of storage from Spray and Bow lakes for the same periods is shown by diagrams, Plates Nos. 15 and 16 respectively.

On the Minnewanka diagram are two lines, the lower shows the effect of the 44,000 ac.-feet available at 12 foot storage (the odd 700 feet is deducted to allow for waste), while the upper shows the effect of the 16-foot storage obtained by drawing the lake down to its original level,

which was raised 4 feet some years ago by a dam at the outlet of the lake. A diagram showing the continued effect of the storage upon the flow of the river at Horseshoe falls (see diagram, Plate No. 17) has also been prepared. This is based upon a storage capacity of 257,300 acre-feet, and after allowing for losses it is considered that 245,200 acre-feet will be available for augmenting the minimum flow; the diagram is based upon the mean monthly flows and is for the period 1909-12, and was compiled from tables Nos. 21, 22 and 23, which are based upon the run-off data for the low water seasons of 1909-10, 1910-11, 1911-12, and show the effect of storage upon the discharge of the Bow river at Kananaskis falls. It will be seen that at the lowest season a discharge of 1,500 second-feet can be secured.

Operation of Storage Season, 1909-1910. Table No. 21.

Month.	Mean Monthly Flow.	Quantity to raise Natural Flow to 800 sec.-ft.		850 sec.-ft.		900 sec.-ft.		950 sec.-ft.		1,000 sec.-ft.		1,200 sec.-ft.		1,500 sec.-ft.	
	c.f.s.	c.f.s.	Ac.-ft.	c.f.s.	Ac.-ft.	c.f.s.	Ac.-ft.	c.f.s.	Ac.-ft.	c.f.s.	Ac.-ft.	c.f.s.	Ac.-ft.	c.f.s.	Ac.-ft.
1909.															
November	1,320													180	10,710·7
December	990									10	614·87	210	12,495·8	510	31,358·7
1910.															
January	910							40	2,459·5	90	5,533·8	290	17,831·4	590	36,277·7
February	790	10	555·37	60	3,332·2	110	6,109·1	160	8,885·9	210	11,662·8	410	22,770·1	710	39,431·4
March	940							10	614·87	60	3,689·2	260	15,986·8	560	34,433·06
April	1,200											0		300	17,851·2
Mean Flow	1,025	Total	555·37		3,332·2		6,109·1		11,960·27		21,500·67		69,084·1		170,062·76

Minnewanka storage = 44,000 acre-feet.
Bow Lake " 27,000 "
Spray Lake " = 160,000 "

Total = 231,000 "
Auxiliary to Minnewanka. = 14,200 "

Grand total = 245,200 acre-feet (Maximum storage).

Storage required during low-water period of 1909-10 for continuous flow of 1,500 sec.-ft. is 170,062·7 acre-feet.
*Therefore surplus water in storage is
231,000 — 170,062 = 60,938 acre-feet.
or 245,200 — 170,062 = 75,138 "

Mean flow for low-water period 1909 and 1910 is 1,025 second-feet.
The regulated flow with Minnewanka storage... 1,148 "
and auxiliary... 1,187 "
Bow lake storage... 1,100 "
Spray lake storage... 1,468 "
Bow and Minnewanka storage combined... 1,223 "
Spray and Minnewanka storage combined... 1,591 "
Spray lake and Bow lake storage combined ... 1,543 "
The regulated flow with maximum storage
Spray, Bow, Minnewanka and auxiliary... 1,705 "

*Therefore maximum storage for 1909-10 for a continuous flow of 1,500 second-feet gives a surplus flow of 205 second-feet.

Month.	Mean Monthly Flow.	Quantity to raise Natural Flow to													
		800 sec.-ft.		850 sec.-ft.		900 sec.-ft.		950 sec.-ft.		1,000 sec.-ft.		1,200 sec.-ft.		1,500 sec.-ft.	
	c.f.s.	c.f.s.	Ac.-ft.	c.f.s.	Ac.-ft.	c.f.s.	Ac.-ft.	c.f.s.	Ac.-ft.	c.f.s.	Ac.-ft.	c.f.s.	Ac.-ft.	c.f.s.	Ac.-ft.
1910.															
November	1,866	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
December	1,483	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1911.														17	1,045·3
January	1,027	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	173	10,637·35	473	29,084·6
February	745	55	3,054·54	105	5,831·40	155	8,608·25	205	11,385·10	255	14,161·96	455	25,269·33	755	41,930·56
March	795	5	307·43	55	3,381·81	105	6,456·19	155	9,530·57	205	12,604·92	405	24,902·47	705	43,348·75
April	827	.....	.....	23	1,368·50	73	4,343·8	123	7,319·0	173	10,294·2	373	22,195·04	673	40,046·3
Mean Flow	1,124	Total...	3,361·97	.....	10,581·76	.....	19,407·24	.....	28,234·67	.....	37,061·0	.....	83,004·2	.....	155,455·5

Minnewanka storage..... 44,000 acre-feet.
Bow Lake storage..... 27,000 "
Spray Lake storage..... 160,000 "

Grand total..... 231,000 acre-feet.
Auxiliary to Minnewanka..... 114,200

Grand total..... 245,200 acre-feet (Maximum storage).

Storage required during low-water period of 1910 and 1911 for a continuous flow of 1,500 second-feet is 155,455 acre-feet.

Therefore Surplus water in storage =
231,000 — 155,455 = 75,545 acre-feet.
or 245,200 — 155,455 = 89,745 "

Mean flow for low-water period 1910 and 1911 is..... 1,124 second-feet.
The regulated flow with Minnewanka storage is..... 1,247 "
The regulated flow with Minnewanka storage and auxiliary storage is..... 1,286 "
The regulated flow with Bow lake storage..... 1,199 "
The regulated flow with Spray lake storage..... 1,576 "
The regulated flow with Bow and Minnewanka storage combined..... 1,322 "
The regulated flow with Spray and Minnewanka storage combined..... 1,690 "
The regulated flow with Spray lake, Bow lake and Minnewanka combined..... 1,765 "
The regulated flow with Spray lake and Bow lake combined 1,642 "
The regulated flow with (maximum storage) Spray, Bow, Minnewanka and auxiliary combined..... 1,804 "

*Therefore maximum storage for 1910 and 1911 for a continuous flow of 1,500 second-feet gives a surplus flow of 304 second-feet over low-water period.

Operation of Storage Season 1911-1912. Table No. 23.

Month.	Mean Monthly Flow.	Quantity to raise Natural Flow to													
		800 sec.-ft.		850 sec.-ft.		900 sec.-ft.		950 sec.-ft.		1,000 sec.-ft.		1,200 sec.-ft.		1,500 sec.-ft.	
	c.f.s.	c.f.s.	Ac.-ft.	c.f.s.	Ac.-ft.	c.f.s.	Ac.-ft.	c.f.s.	Ac.-ft.	c.f.s.	Ac.-ft.	c.f.s.	Ac.-ft.	c.f.s.	Ac.-ft.
1911.															
November	1,056	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	144	8,568·6	444	26,419·8
December	836	.....	.....	14	860·8	64	3,935·2	114	7,009·5	164	10,083·9	364	22,381·4	664	40,826·7
1912.															
January	786	14	860·8	64	3,935·2	114	7,009·5	164	10,083·9	214	13,158·3	414	25,455·8	714	43,902·1
February	766	34	1,955·7	84	4,831·7	134	7,707·7	184	10,583·7	234	13,459·7	434	24,936·7	734	42,219·7
March	720	80	4,919·0	130	7,993·4	180	11,067·7	230	14,142·2	280	17,216·5	480	29,514·0	780	47,960·3
April	835	.....	.....	15	892·5	65	3,867·7	115	6,843·0	165	9,817·6	365	21,719·0	665	39,570·2
Mean Flow	833	Total...	7,735·5	.....	18,513·6	.....	35,587·8	.....	48,662·3	.....	63,736·0	.....	132,574·5	.....	240,898·8

Minnewanka storage ..... = 44,000 acre-feet.
Bow lake storage ..... = 27,000 "
Spray lake storage ..... = 160,000 "

*Total ..... = 231,000
Auxiliary to Minnewanka ..... = 14,200 "

†Grand total ..... = 245,200 "

*Would give a regulated flow over low-water period 1911 and 1912, 1,473·0 second-feet.

†Would give a regulated flow over low-water period 1911 and 1912, 1,512·0 second-feet.

Mean flow low-water period 1911 and 1912 is ..... 833 second-feet.
The regulated flow with Minnewanka storage is (833+122). 955 "
The regulated flow with auxiliary storage from Minnewanka is (955+39) ..... 994 "
The regulated flow with Bow lake storage (833+75) ..... 908 "
The regulated flow with Spray lake storage (833+443) ..... 1,276 "
The regulated flow with Bow lake added to Minnewanka .. 1,030 "
The regulated flow with Bow lake added to Minnewanka with auxiliary ..... 1,069 "
The regulated flow with Spray and Bow lake combined 1,351
The regulated flow with Spray added to Bow, Minnewanka and auxiliary (Maximum storage) ..... 1,512 "
The regulated flow with Spray lake and Minnewanka combined ..... 1,398 "
The maximum storage for 1911 and 1912 will give a continuous flow over the low-water period of ..... 1,512 "

Tables

In preparing the tables Nos. 21, 22, 23, the effect to be obtained from storage is taken as that due to a discharge of 160,000 acre-feet from the proposed Spray basin, 27,000 acre-feet from the Bow lake basin and 44,000 acre-feet from lake Minnewanka. In addition to this, there can be made available at lake Minnewanka, a storage of 14,200 acre-feet between the present normal lake level, 4,728 and 4,724.

Explanation.

The tables give the necessary quantity in cubic feet per second, and in acre-feet, required to raise the mean monthly flow from that recorded to discharges, ranging from 800 c.f.s. to 1,500 c.f.s. At the bottom of each column is given the mean flow for the low-water period, together with the total in acre-feet necessary to produce the given discharge for the period. Below the table is given the effect in concise form, of the flow from each storage basin upon the discharge and finally the combined effect of all the storage basins upon the flow.

For the low-water period 1909-10, the mean discharge for the period for an average month is 1,025 c.f.s. With this as a basis, from the table we find that providing for a flow of 1,500 c.f.s. over the low-water period, November to April, inclusive, there will be a surplus of 60,938 acre-feet, without making use of the extra storage available in Minnewanka, or including 14,200 acre-feet auxiliary storage, a total of 75,138 acre-feet, sufficient to provide for a flow of 1705 c.f.s. over the whole period.

For the low-water period 1910-11, the mean discharge is 1,124 c.f.s., over the whole period. As before, providing for a continuous flow of 1,500 c.f.s. over this period, there is a surplus (omitting as before the auxiliary storage) of 75,545 acre-feet, or including the 14,200 acre-feet auxiliary storage a total of 89,745 acre-feet, which would give a continuous flow from October to April, of 1804 c.f.s.

During the period 1911-12, the mean flow is only 833 c.f.s., and to secure a flow of 1,500 c.f.s., the entire storage capacity, including the auxiliary 14,200 acre-feet, a total of 245,200 acre-feet would have to be utilized.

From these figures it seems reasonably certain therefore that a flow of 1,500 second-feet can be maintained; during seasons of unusually low water, this may possibly not be realized, and records over a longer period would give the conclusions drawn, more weight, but in the absence of more complete information this flow has been accepted as reasonably certain and it is the discharge upon which the developments between Horseshoe falls and Ghost river have been based.

Below the mouth of the Ghost these figures are increased; from the data available it seems reasonable to expect a minimum flow of 100 cubic feet per second during the low-water period, from this river, so that the minimum regulated flow should be increased to 1,600 c.f.s. for points below the mouth of that river.

For the low-water season, October 1st to March 31, 1911-12, from the precipitation data it is found that the precipitation was less than for any season during the last eight years, and the total precipitation for the water year 1911-12 was just 0.38 inch higher than the mean flow over a period of sixteen years. The above assumption regarding discharge in view of this seems reasonable.

Effect below Calgary.

Below Calgary, the effect of storage on the Elbow would be apparent. The amount of storage on this river is taken at 23,000 acre-feet, giving a total available storage for points below Calgary of 268,200 acre-feet. Diagram Plate No. 18 has been plotted: it gives the mean monthly discharge in acre-feet of the

BOW RIVER
AT
HORSESHOE FALLS

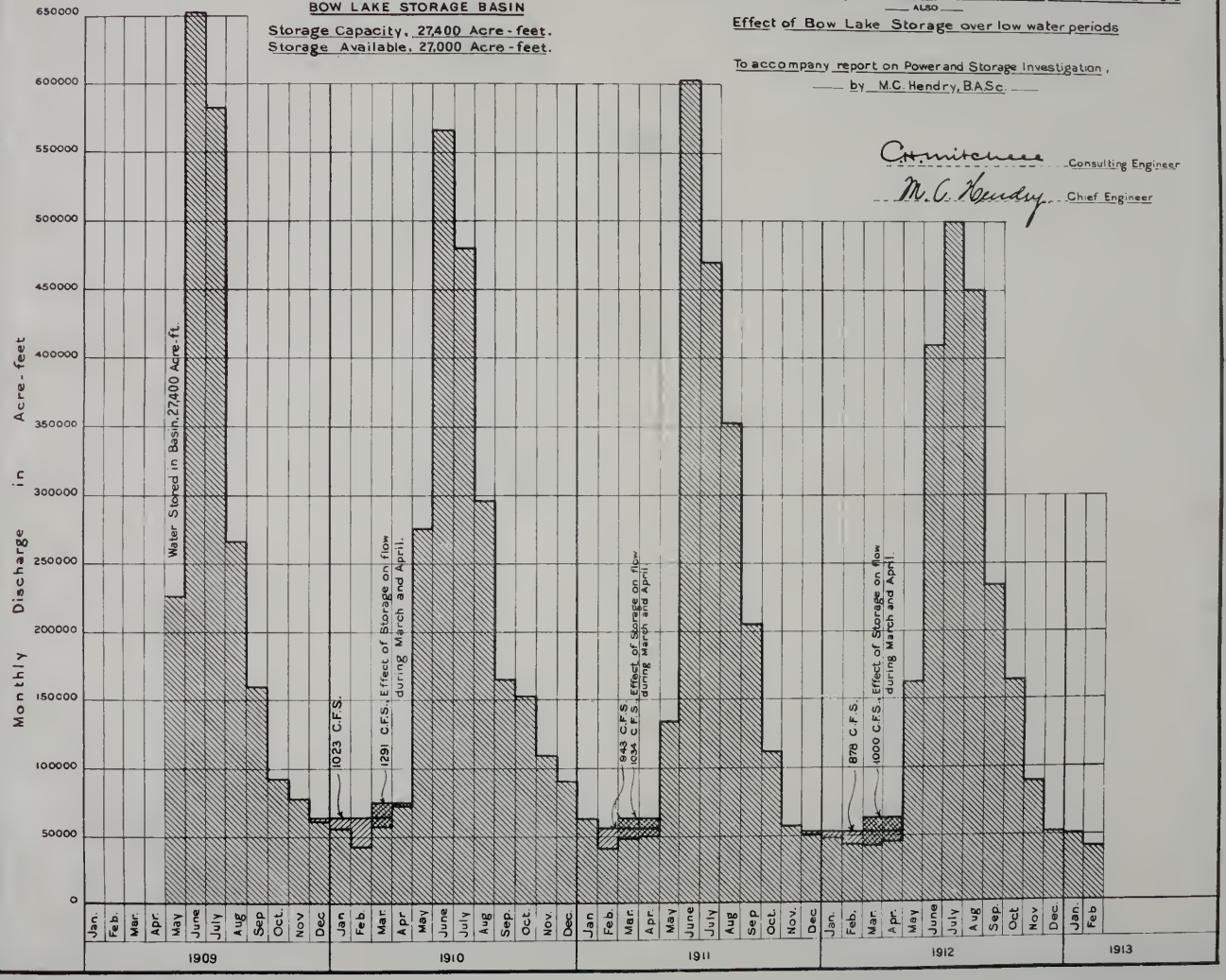
Diagram shewing Discharge in Acre-Feet, from May 1909 to Feb. 1913
ALSO
Effect of Bow Lake Storage over low water periods

To accompany report on Power and Storage Investigation,
by M.C. Hendry, B.A.Sc.

Consulting Engineer

M.C. Hendry Chief Engineer

BOW LAKE STORAGE BASIN
Storage Capacity, 27,400 Acre-feet.
Storage Available, 27,000 Acre-feet.



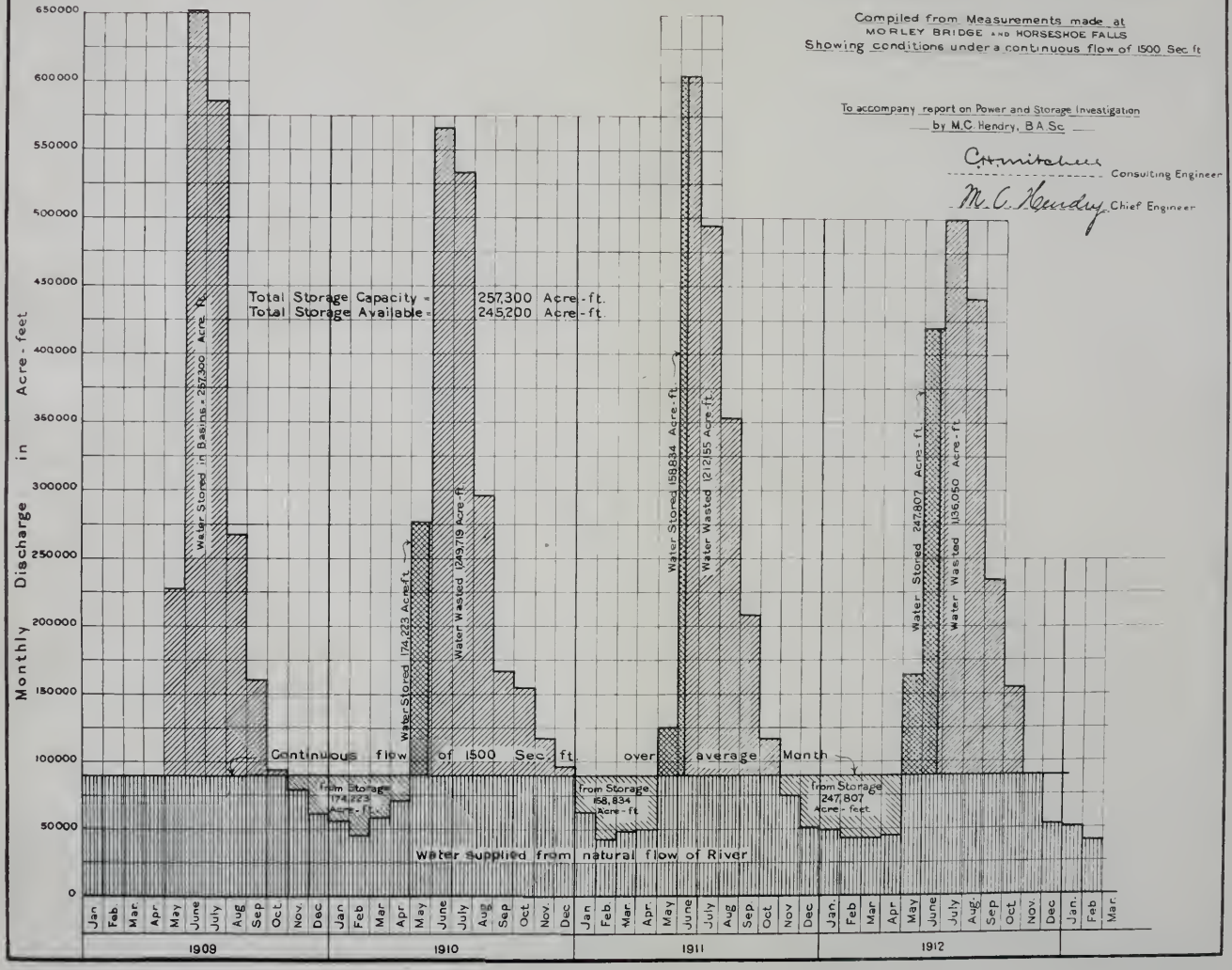
BOW RIVER
AT
HORSESHOE FALLS

Diagram of Discharge in Acre-ft. from Jan. 1909 to Feb 1913

Compiled from Measurements made at
MORLEY BRIDGE AND HORSESHOE FALLS
Showing conditions under a continuous flow of 1500 Sec ft

To accompany report on Power and Storage Investigation
by M.C. Hendry, B.A.Sc.

C.H. Mitchell — Consulting Engineer
M.C. Hendry — Chief Engineer



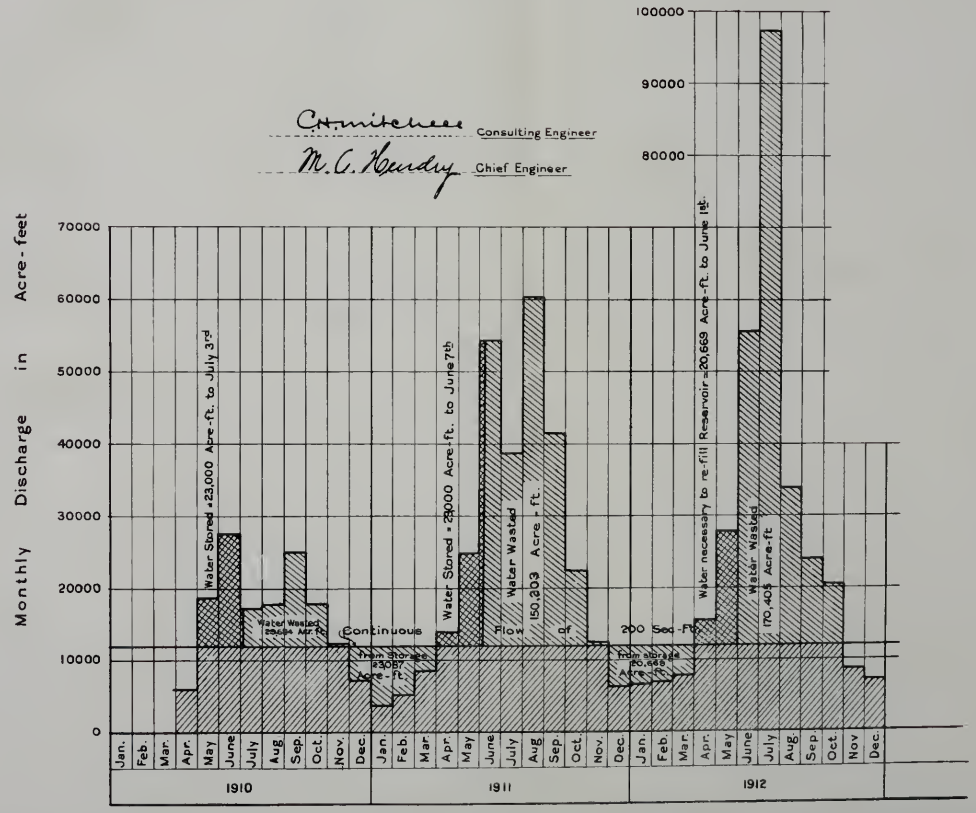
ELBOW RIVER STORAGE

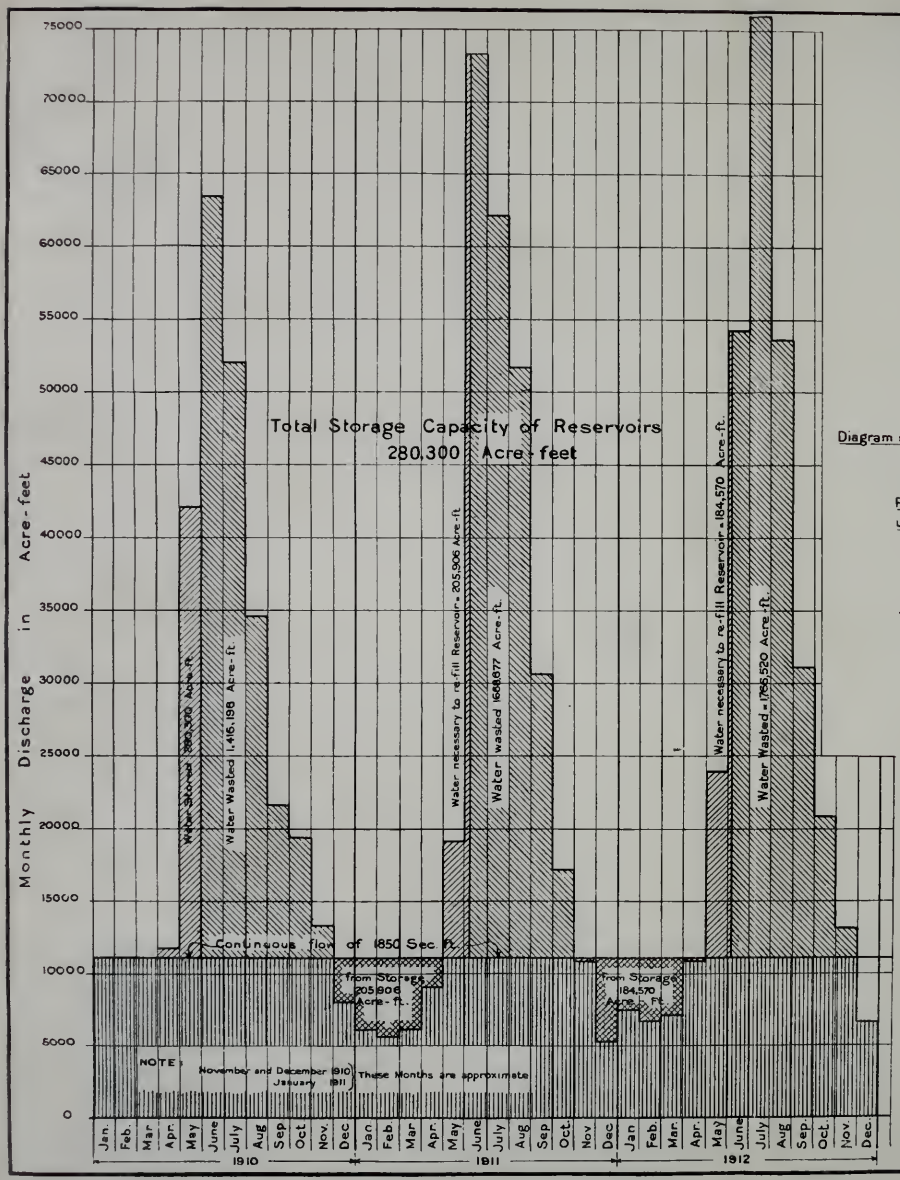
Diagram shewing Discharge in Acre-Feet, from Apr. 1910 to Dec. 1912
also
Process of Filling Basin, and providing for a constant Discharge of 200 Sec.-Ft.

To accompany report on Power and Storage Investigation
by M.C. Hendry, B.A.Sc.

C.H. Mitchell Consulting Engineer

M.C. Hendry Chief Engineer





BOW RIVER

Diagram shewing Discharge in Acre-ft. from Jan. 1910 to Dec. 1912
below
CALGARY
—ALSO—
Record of filling Storage Basins and water wasted
under a continuous flow of 1850 Cubic Ft. per Sec.

To accompany report on Power and Storage Investigation
—— By M.C. Hendry, B.A.Sc. ——

C. Monitzen ---------- Consulting Engineer

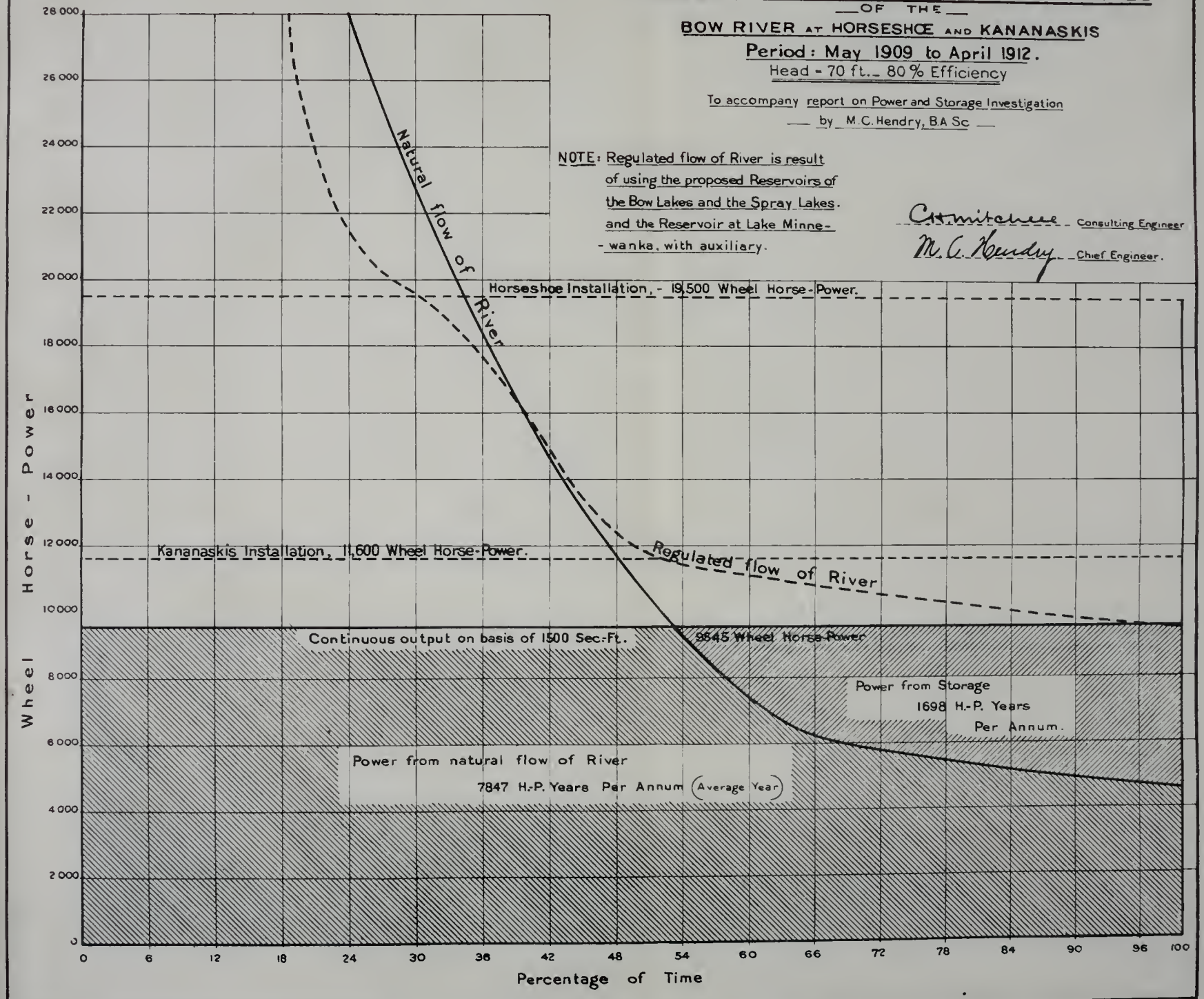
M.C. Hendry ---------- Chief Engineer

POWER - PERCENTAGE OF TIME CURVES
OF THE
BOW RIVER AT HORSESHOE AND KANANASKIS
Period: May 1909 to April 1912.
Head = 70 ft. - 80% Efficiency

To accompany report on Power and Storage Investigation
by M.C. Hendry, B.A.Sc.

NOTE: Regulated flow of River is result of using the proposed Reservoirs of the Bow Lakes and the Spray Lakes. and the Reservoir at Lake Minne-wanka, with auxiliary.

C.S. Mitchell — Consulting Engineer
M.C. Hendry — Chief Engineer.

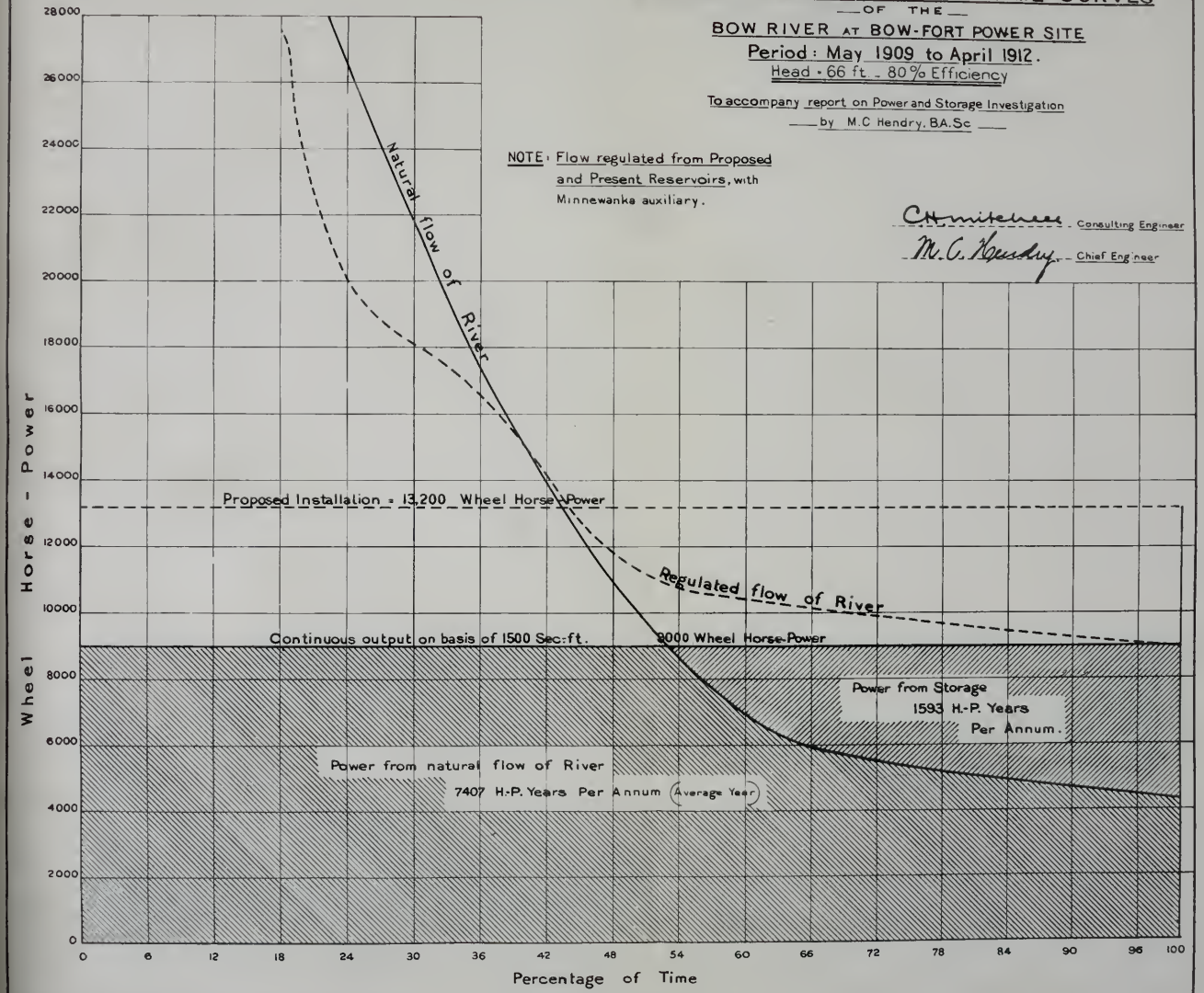


POWER - PERCENTAGE OF TIME CURVES
—OF THE—
BOW RIVER AT BOW-FORT POWER SITE
Period: May 1909 to April 1912.
Head - 66 ft. - 80% Efficiency

To accompany report on Power and Storage Investigation
—by M.C Hendry, B.A.Sc—

NOTE: Flow regulated from Proposed and Present Reservoirs, with Minnewanka auxiliary.

C H Mitchell - Consulting Engineer
M.C. Hendry - Chief Engineer



Elbow at its mouth and shows the effect of storage from 1910-1912. Diagram Plate No. 19 illustrates the effect of the combined storage on the Bow river below Calgary and amount necessary to secure a flow of 1,850 c.f.s.; a study of this diagram reveals the fact that regulating the storage on the Elbow to secure a flow of 200 c.f.s. at the site below Canyon creek, and the storage on the Bow from Kananaskis falls would give a flow of approximately 1,850 c.f.s. below Calgary. It is apparent from the diagram, however, that this would be exceeded by at least 200 c.f.s., due to the flow of water into the Bow below the Ghost, of which there is no record during the low water months.

CONCLUSION.

Effect of Storage on Discharge.

Using a storage capacity of 243,100 acre-feet and an auxiliary storage at lake Minnewanka of 14,200 acre-feet, a flow of 1,500 second-feet may be maintained over the low-water period of any year, between Kananaskis falls and the mouth of the Ghost river; during years of ordinary precipitation, this may go as high as 1,700 c.f.s.

Below the mouth of the Ghost river, the regulated flow may be increased by at least 100 c.f.s., or say from the Ghost to Radnor a continuous flow of 1,600 c.f.s. would be available; during some seasons it might go as high as 1,800 c.f.s.

The data are not available for the discharge of creeks tributary to the Bow between Radnor and Calgary during low-water months, but below Calgary and including the regulated flow of the Elbow, a flow of nearly 2,000 c.f.s. may be expected during the low water period.

Effect of Storage on Power Output.

In addition to the foregoing tables and hydrographs, some curves have been prepared (see Plates Nos. 20, 21, 22, 23, 24). These show the effect of the total available storage in the basin (developed and undeveloped) upon the power producing of the river. These curves are plotted for each of the plants built and proposed and are known as "Power-percentage of time curves." The period for which they are plotted is from May, 1909, to April, 1912, embracing practically all the records available. The ordinates of the curves represent wheel horse-power, and the abscissae time, in percentages, 100 per cent being equal to the period given above. Two curves are plotted, one in a full line being that derived from the natural flow during the period, and the broken line that from the regulated flow.

Diagram, Plate No. 20 has curves for both the Horseshoe Falls and Kananaskis Falls plants; referring to the curve derived from the natural flow of the river, under a head of 70 feet and with 80 per cent efficiency, the power that could be derived from the natural flow of the river, 24 per cent of the period, would be 28,000 wheel horse-power; that due to the regulated flow for the same time would be 21,400 wheel horse-power. Where the regulated flow is less than the natural flow, the power derived is less and where the former is greater the power derived is greater; for 100 per cent of the period the natural flow would produce about 4,580 wheel horse-power and the regulated flow would produce 9,545 wheel horse-power; that is 24-hour power, 365 days a year. Of this, 7,847 horse-power years would be due to the natural flow of the river and 1,698 horse-power years due to the release of water from storage.

For the Kananaskis Falls plant the output in an average year from the natural flow of the river would be, for the turbine installation, 8,101 horse-

power years. With the proposed regulated flow this could be increased by 1,863 horse-power years, giving a total annual output of 9,964 horse-power years.

For the Horseshoe Falls plant the same curve applies, the head and regulated flow being the same. Here, however, the turbine installation is greater, being 19,500 horse-power from the curve, it will be seen that the total annual output due to the natural flow would be 12,087 horse-power years, to which may be added, due to stream regulation, 2,171 horse-power years, giving the total annual output of 14,258 horse-power years.

The other curves for the undeveloped sites are worked out on the same basis and the results are tabulated in table No. 5 so that further explanation is hardly necessary.

Auxiliary Storage.

Where the main storage basins are so remote from the point of utilization as in the Bow basin, some auxiliary storage of sufficient capacity to tide the plant over a sudden drop in the flow is necessary. The amount of storage that may be developed in connection with each plant is rather limited, the river is confined mainly between high banks so that any increase in level produces a very small increase in area; this is especially the case at the present plant at Horseshoe falls; from the dam to the foot of Kananaskis falls the banks are high and the present flooded area is but little in excess of the former area of the river.

At Horseshoe falls the area of the pond above the plant is 98.5 acres which, with a draw down of 4 feet, has a capacity of 394 acre-feet, capable of supporting a discharge of 200 second-feet for twenty-four hours; this might be sufficient over a short period, but is of little value when a reduction of flow takes place. At such a time it becomes necessary to sustain the flow for the eighteen to twenty-four hours which must elapse before the effect of storage above can be felt.

The Horseshoe Falls plant is, of all the developments built or proposed, the least favourably situated in this regard. The plant at present building at Kananaskis, though better situated, has very little advantage in respect to storage area. When the elevations of the structure are finally settled, the depth of storage possible may be found to be in excess of that at the Horseshoe Falls plant, but with a draw down of 4 feet as before, and a pond area above the dam of 122.25 acres, a total of 489 acre-feet would be available; this would provide a flow of 258 second-feet for twenty-four hours.

The drawing down of the head-water, however, makes a serious inroad upon the output of the plant; the storage propositions looked into on the Kananaskis river within a radius of 8 or 10 miles of Kananaskis falls have been made with a view to eliminating this trouble as much as possible.

An examination was made of the Kananaskis river during the summer of 1912, to investigate the possibility of creating storage in lake Chiniki by damming the river and raising the water to a sufficient height to flow into the lake, to be there stored until needed. It was found that it would be necessary to go a long way upstream to raise the water to the desired height, and also that to return the water to the river it would be necessary to re-traverse or cut through a height of land between the lake and the river; this would involve considerable work, as the summit, though not high, is long.

There are several possible dam sites within a distance of 8 miles from the mouth of the river, at which the water might be raised 40 or 50 feet; the amount of storage these would create would be small, and only a survey in detail would reveal the value of the several basins so created; these were dealt with before.

The other proposed developments are rather better situated than the present two, the area of the ponds at these several sites are as follows:—

TABLE No. 24.

PONDAGE AREA ABOVE EACH PLANT.

Site.	Pond Area.
Bow Fort	205 acres.
Mission	353 "
Ghost	786 "
Radnor	241 "

In connection with the Ghost and Radnor sites, the question of storage on the Ghost river was looked into. A possible storage basin of small area near the mouth of the river, and of which plans accompany this report, was developed in some detail; the site, however, is not considered attractive as the capacity for storage is limited and the structure involved large.

ICE CONDITIONS BELOW STORAGE BASINS.

At the end of last winter an examination was made of the river between Banff and Kananaskis falls; also of the Cascade river between lake Minnewanka and the mouth, and the Spray river for about 8 miles from the mouth. A number of photographs were taken to illustrate ice conditions found at different points on the rivers, some of these are reproduced here.

Between Kananaskis falls and the mouth of the Cascade the Bow, when examined, was for the most part open, and in a few places only was there evidence of overflow. Below the Spray falls on the Bow, where the formation of frazil would be excessive, there was little evidence of clogging and overflow, the river being entirely confined to the channels. On the Spray river, as far as examined, the same conditions obtained; for the first 4 miles above the mouth, the river was entirely ice bound, above that point the river was open in many places, and, although some overflow had occurred, the amount was so small that it was practically negligible.

On the Cascade, the conditions encountered were somewhat different. Between the storage dam and Bankhead, the river was practically clear of ice, and there was no evidence of the formation of any large quantity. This condition showed a reversal of the conditions found in March, 1912, for, after a certain amount of water had been discharged from the lake in 1913, large quantities of ice were found upon the flats below Bankhead, and these extended nearly to the mouth. In many places this ice was in fields, 4 and 5 feet thick, and 400 to 500 feet wide; below the Canadian Pacific Railway bridge the ice was in even greater quantities and much thicker.

These conditions were due largely to the nature of the river bed, and also the method of releasing the water from storage. During the early part of any cold spell (as evidenced by the records), the flow in the stream was small and the channel narrow and easily blocked during severe weather by frazil and anchor ice; when water was released, the choking of the channels increased, and flooding and consequent ice formation took place. Reproductions, pages 19, 20, 24 and 25 illustrate the resulting conditions.

STORAGE MANIPULATION.

The question of regulation of discharge from the different storage basins is one requiring care and experience. During the first few years of operation it is not expected that they can be operated to secure the maximum efficiency though regulation should improve as the amount of data is increased.

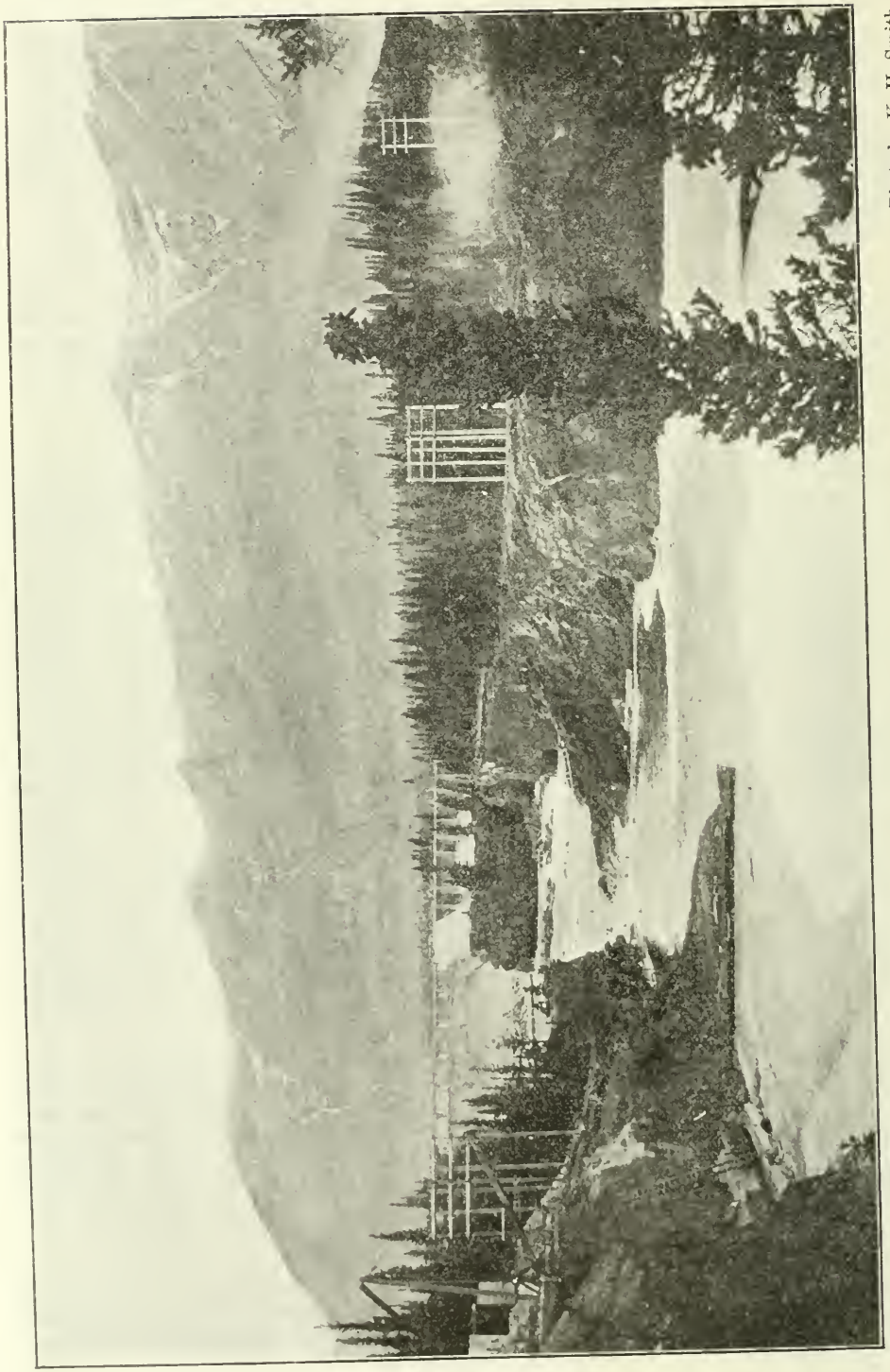


Photo by K .H. Smith.

Kananaskis Falls after Construction.

The comparative remoteness of the several storage basins from the power-producing sections of the river, prevents any close regulation of the flow at the plants, for it is estimated that it will take at least 18 hours before water released from Minnewanka will reach Kananaskis Falls.

During the last winter, owing to the difficulty of anticipating temperature changes (the controlling factor), water released from Minnewanka did not reach the plant until the extreme conditions due to the weather had partially adjusted themselves; also, a large percentage of the water was wasted in transit, especially in the upper part of the river near the basin, in the form of ice. It is scarcely fair, however, to use the first season of regulation as a basis for reaching definite conclusions as to the benefits to be secured, for it must be remembered that, besides lack of experience in handling the storage, other things militated against maximum efficiency; for instance, between Bankhead and the mouth of the Cascade, no improvement to the river bed has been made, thus much of the water released spreads over the flats, freezes and is wasted.

Diagram, Plate No. 3 shows not only the marked influence of temperature upon discharge, but also shows when and to what extent storage was supplied, for the recorded levels indicate the discharge indirectly; it may safely be assumed that when the surface level remains constant there is no discharge, and when the lake level falls, water is being discharged from storage; also the rate of decrease in the lake level indicates the rate of discharge.

The wasting of water by ice formation on the flats, as mentioned above, is due, in a very great measure, to the method of storage manipulation.

A study of other rivers in the vicinity during the past season has led to the conclusion that if the channel is kept open, little clogging and overflow occur.

It will be noted in nearly every case, that for a varying length of time, immediately preceding a period of low temperature, and during the first part of that period, the flow from storage was that of the normal flow of the river. Later, the water released from storage met with a condition in the river, a channel restricted and clogged with ice, the result being an overflow and excessive ice formation in the river valley.

The opinion is advanced that, under the normal conditions of the river, or where the normal discharge is fairly large and constant the ice troubles will be very appreciably reduced.

It is therefore expected that, with the building of a power plant upon the Cascade, immediately below the storage dam, and the consequent nearly constant discharge, the channel will be kept in fair condition, which will go far to eliminate the trouble.

The discharge from Spray Lake basins will take even longer to reach the plants, so that any attempt at regulation would be of little benefit; it is therefore proposed in regard to that basin to keep the flow fairly constant during the low water period, and do any necessary regulation near the plants.

A fairly large flow or discharge from Spray lakes will, it is expected, eliminate, to a very great extent, the trouble and losses due to ice. During the last winter season, the river was examined for a distance of about 8 miles, and while the flow was fairly large, the amount of ice formed was comparatively small, only at two or three points in the section examined was there evidence of blocking and overflow; these were of very small extent.

The manipulation of the proposed Bow lake storage presents further difficulties, but by special treatment these may be overcome.

To attempt to secure a continuous discharge from that source throughout the winter months, would mean practically the entire loss of the value of the storage, the nature of the channel through which the water flows being very similar to that of the Cascade for nearly the entire length above Laggan. In order that the maximum benefit may be secured from this basin, it is proposed to

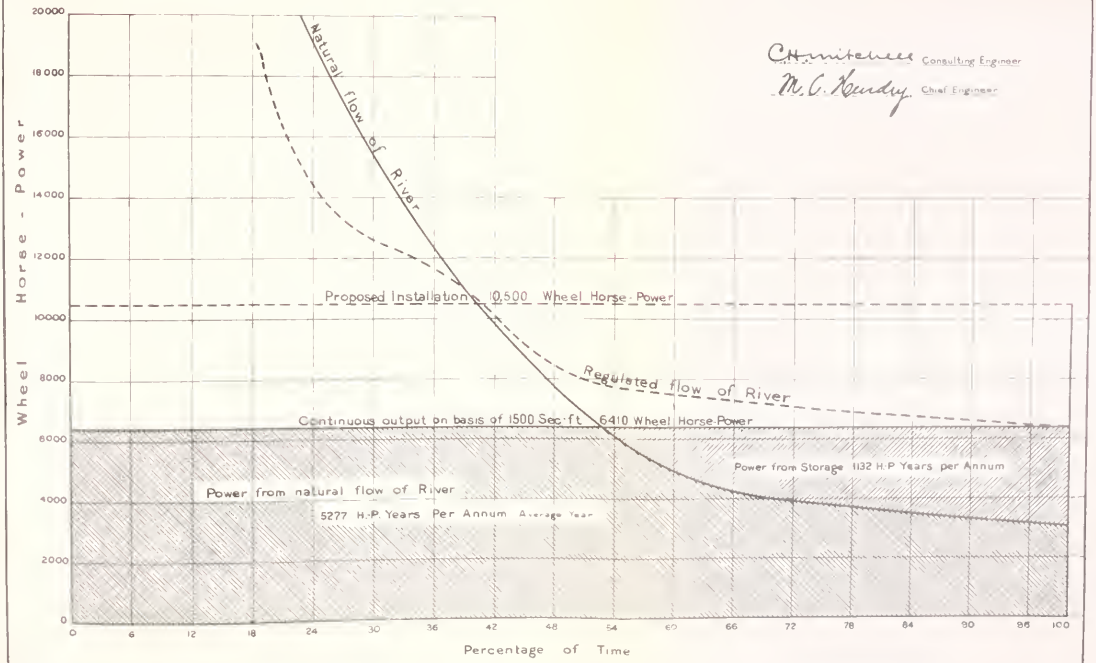
release the water during one or two months only and hold it through the severe weather, say from December to March. In some years it may be found advantageous not to release any water during November, but hold the whole amount for use during March and April; this would probably secure the greatest efficiency, for the release of water during November might mean a loss of a considerable amount owing to cold weather towards the end of the month, while in March and April the conditions for discharging are improving.

POWER - PERCENTAGE OF TIME CURVES
— OF THE —
BOW RIVER AT MISSION POWER SITE
Period : May 1909 to April 1912.
Head - 47 ft. - 80% Efficiency

NOTE Flow regulated from Proposed and Present Reservoirs.

To accompany report on Power and Storage Investigation by M.C. Hendry, B.A.Sc.

C.H. Mitchell Consulting Engineer
M.C. Hendry Chief Engineer

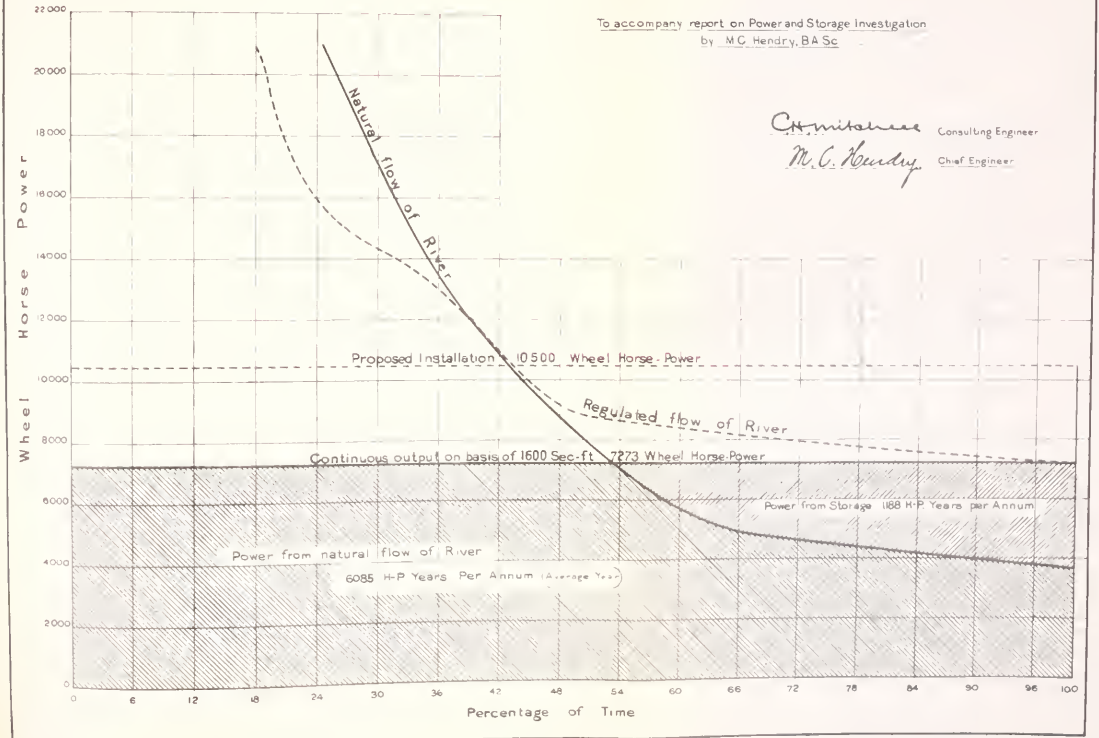


NOTE Regulated flow of River is result of using Present and Proposed Storage

POWER - PERCENTAGE OF TIME CURVES
OF THE
BOW RIVER AT GHOST POWER SITE
Period : May 1909 to April 1912.
Head - 50 ft. 80% Efficiency

To accompany report on Power and Storage Investigation
by M.C. Hendry, B.A.Sc.

C.H. Mitchell Consulting Engineer
M.C. Hendry Chief Engineer

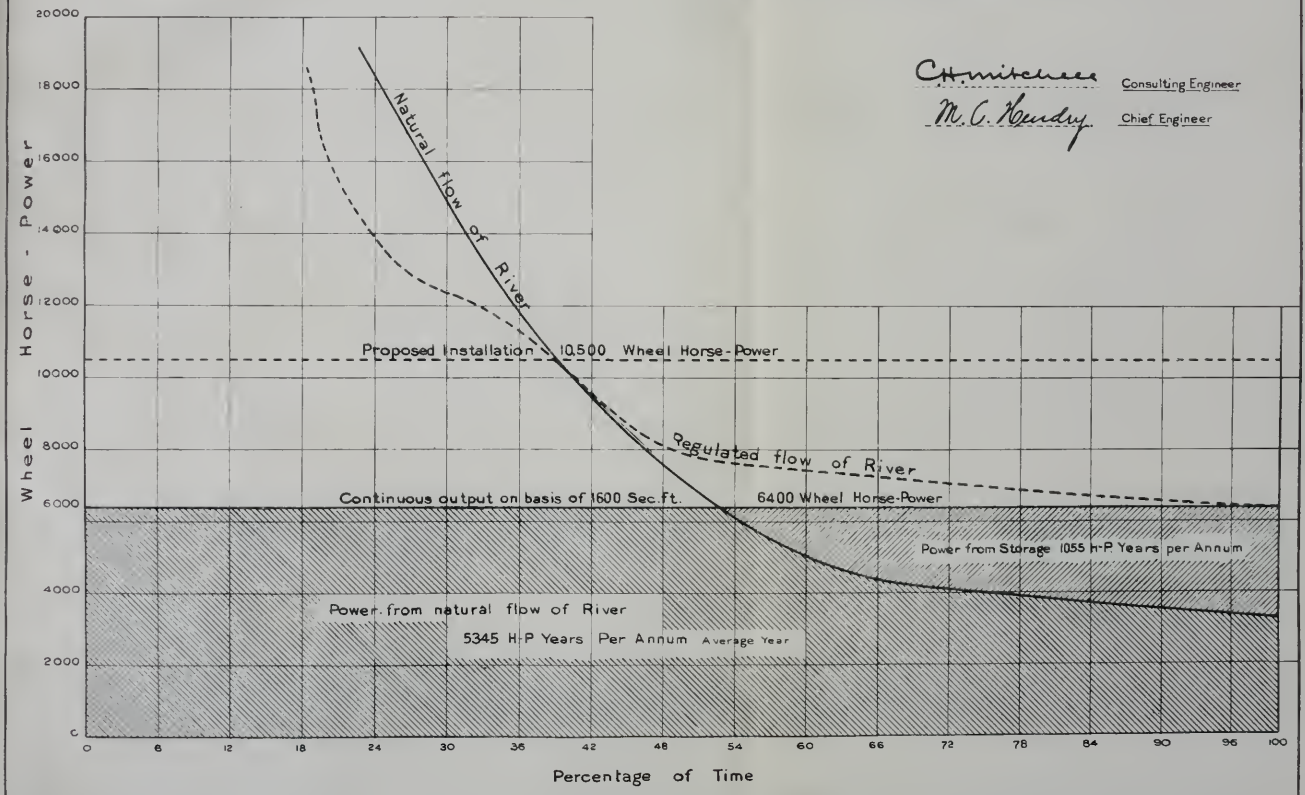


POWER - PERCENTAGE OF TIME CURVES
— OF THE —
BOW RIVER AT RADNOR POWER SITE
Period : May 1909 to April 1912.
Head = 44 ft. 80% Efficiency

NOTE Regulated flow of River is result of using Present and Proposed Storage

To accompany report on Power and Storage Investigation
— by M.C. Hendry B.A.Sc. —

C.H. Mitchell Consulting Engineer
M.C. Hendry Chief Engineer



CHAPTER XII.

IRRIGATION.

General.

The question of the effect of the creation of storage upon irrigation requirements is one which must be considered at the same time as that of its effect on the power interests.

Calgary lies on the western and Regina on the eastern limit of a dry belt, in which the soil is, for the most part, very fertile.

From time to time irrigation has been attempted in this district, the first scheme being on Fish creek as early as 1879. Numerous other small schemes were instituted, but it was not until 1893 that an undertaking of any magnitude was begun. The two largest undertakings were those of the Calgary Hydraulic Company, with head-works on the Elbow river west of Calgary, and the Calgary Irrigation Company, whose head-works were also on the Elbow river; by the end of 1894 there were projects of all sizes in operation to the total number of seventy.

The increase in irrigation undertakings was continuous until, by the year 1902, the number of ditches in operation was 169, capable of irrigating 614,684 acres. Recently some of the schemes have been abandoned; one of these is that of the Calgary Hydraulic Company.

About 1905 the Canadian Pacific Railway Company became an active advocate of irrigation, and instituted the scheme which, at present, is the largest and most comprehensive reclamation undertaking in the Canadian West; a main channel with head-works just below the junction of the Bow and Elbow rivers carries water to irrigate land to the north and east of Calgary, while the principal undertaking is farther to the east, and it has recently constructed a large dam near Bassano to serve 513,000 acres of irrigable land.

Relation of Power and Irrigation Requirements.

It is well to recognize that the agricultural industry, with its accompanying irrigation requirements, is pre-eminent in this locality, and must consequently take precedence of all power requirements as regards the use of water.

When this investigation of the Bow river water supply was first undertaken there was some apprehension that possibly there might be a conflict of interests in the adjustment of water supply. As, however, the investigations were proceeded with and broadened it was rapidly discovered that instead of any interference there was, on the other hand, rather a co-operative effect. On the broad principle that any storage project will equally assist both power production and irrigation in supplying ample water for their requirements, it is obvious that there can be no interference of rights if the river discharge is equitably controlled so as to be uniform throughout the spring and autumn.

Fortunately the requirements for irrigation exist only throughout what may be termed high and normal water periods of the river, commencing not earlier than April 7 and extending not later than September 30. Of these summer months at least three have high flood discharge on this river, whilst the other two, viz., May and September, produce discharges larger than the proposed new regulated flow of 1,500 second-feet at, say, Morley. The effect

of the withdrawal of water by storage on the high summer flood, cannot be such as to interfere with efficient irrigation; on the contrary, provision is made for the future, because such a large supply cannot be maintained throughout the entire irrigable season, and the month of April is much improved by storage while September remains as before.

Under any circumstances, during the operations of water control and supply from storage reservoirs, the requirements of irrigation should be kept clearly in mind, and in the face of a threatened shortage, the reasonable demands of irrigation must be given precedence.

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APPENDIX I.

RECOMMENDATIONS *RE* A POLICY OF STORAGE AND REGULATION ON THE BOW RIVER.

BY

C. H. MITCHELL, C.E.

RECOMMENDATIONS RE POLICY OF STORAGE AND REGULATION ON THE BOW RIVER.

(By C. H. Mitchell, C.E.)

March 31, 1914.

J. B. Challies, Esq.,
Superintendent of Water Power Branch,
Department of the Interior,
Ottawa.

Dear Sir,—In concluding my investigations and study of the Bow river and its basin with respect to water supply, storage and regulation of discharge, I have the following to bring to your attention. This report embraces recommendations and suggestions for giving practical effect to the conclusions which we have reached.

Scope.

The conclusions herein contained have reference to the water supply question solely with respect to the regulation and control of the river so as to equalize the discharge in the most advantageous manner for power purposes keeping in mind the requirements of irrigation.

General.

If the country in the foot-hills east of the Rockies and within transmission radius of the Bow river is to be encouraged as an industrial region, the utilization of its natural resources is an economic necessity and the utmost development of the water power of the Bow river is a logical outcome. In this region there are already rapidly-growing industrial communities and their steady growth is dependent on probably no more important factor than an ample supply of power.

The Bow river is peculiar in that, in its natural condition, its high summer-flood discharge is upwards of seventy times its low-water winter discharge. a condition which obviously renders its use, in its present state, unsuitable, inefficient and commercially unfeasible for power purposes.

The investigations which have been carried on during the past two years, the results of which have been embodied in the general report of Mr. Hendry and in which I have collaborated, indicate that if the Bow river is to be an efficient commercial source of power and at the same time to afford all ample water supply for irrigation purposes it is absolutely necessary that the river be regulated and controlled so as to ensure a fixed and useful supply of water continuously throughout the year.

Conditions to be Met.

If the improvement of Bow river is undertaken for the advantage of the power and irrigation industries it is obvious that it should be done by, and remain under the control of, the Government because of the many conflicting interests of water demand which would be involved. In addition to the irri-

gation interests, there are, or are likely to be, several power companies all requiring water in some degree of uniformity throughout the year. Such being the case, it is evident that once the storage system is constructed, its satisfactory operation, impartial and efficient, can be secured only through the medium of some central official body, exercising an absolute control over the water supply so as to obtain the greatest advantage and efficiency to the largest proportion of public users. All users must be made parties to the arrangement so as to make it completely co-operative.

Policy to be Framed.

If this water supply project is undertaken as a work of public benefit by the Dominion Government, it would naturally be the function of the Water Power Branch of the Department of the Interior to carry it out and subsequently administer its operation. To carry this to a successful issue, looking to the distant as well as the immediate future, it appears to me that a definite departmental policy will require to be framed with respect to:—

A.—Investigations as to: (1) the requirements and the possibilities, and as to (2) the betterment of the conditions under which the project is to be administered and operated.

B.—Construction of storage reservoirs and regulating works on the river and its head-waters.

C.—Operation of the storage, and regulating works for the benefit of all concerned.

There need be no alteration in the policy of the department with respect to power sites, leases and operative conditions thereof except in so far as they may be affected by the supply of the additional water furnished under the storage and regulating project.

A.—Investigation.—The work which has been carried on by the Water Power Branch on the Bow river during the past two years, the results of which are now being published, constitutes practically the whole of the investigation preliminary to the undertaking of this project. So far as it has been possible to carry this investigation up to the present, it is reasonably complete, pending the development of a definite policy to be laid down.

Some of the data upon which the general project is based, being obtained from various sources, have by necessity been meagre because of the short period over which the investigations have been made. It has been necessary to employ data which were originally made for other purposes and with another viewpoint, whilst on the other hand, if data obtained especially for this purpose were to be secured, a long term of years would elapse and the project be delayed in its consummation.

On account of the foregoing, it appears now to be necessary to continue the periodic collection of data and to further investigate the performance of the river and its tributaries so that as time goes on, whether actual construction is entered upon or not, a continuous cycle of records becomes available. This applies more particularly to: (1) River gaugings, more especially on the separate tributaries; (2) precipitation records, especially in new stations nearer the headwaters and at a higher altitude; (3) temperature records at the same stations; (4) observations on the diminution of glaciers; (5) observations regarding water elevations along Bow river; (6) effect of winter conditions on the flow in the Bow river tributaries; and (7) observations regarding seepage.

It is also of the greatest importance that, after operation of the storage works is commenced, a careful study and analysis be made of the performance of the various storage basins, their sources, water supplied by the various tributaries of the river and their performance during regulating operations in the winter months and the other controlling factors entering into the regulation of water supply so as to secure the best results.

B.—Construction.—The construction work involved in this project in its entirety, in accordance with the report, comprises storage and regulating dams on:—

1. Lake Minnewanka.
2. Bow lake
3. Spray River canyon (Spray lakes).

In order to carry this whole project to its logical conclusion, it is evident that the construction of these reservoirs should be undertaken as a Government work in the same manner as the Government constructs other public improvements for the benefit of the locality or the country at large. This undertaking has a strong point in its favour, in that the Government can very rightly recover the whole or a portion of the cost of the work in the form of annual rentals charged to the various users for the additional water thus supplied. These rentals can be adjusted amongst the various power companies or power sites in the leases given by the department, and be recoverable with the annual power rentals. The basis of water charge can be adjusted either according to quantity of water used or to power produced, arranged on some equitable scale.

The first of the foregoing works has already been constructed and was finished in time to catch the 1912 summer flood; the performance of this reservoir and its regulation during the past winter has been made the subject of considerable study and will form the basis of the further investigations which I have suggested above. This reservoir with its accessory works was constructed at the expense of the Calgary Power Company with an arrangement whereby the Government may take it over at cost at any time in the future, and on this account the work was done under the supervision of the Government's engineers and accepted by them with a view to its ultimately becoming a part of the proposed storage and regulation system. In this respect, therefore, the way is already prepared for carrying out the Governmental policy outlined above.

Co-operation.

As has already been stated, it is necessary to the success of the project that the operation of the storage and regulation be solely under the control of the Government. The authority could best be vested in an engineer located on the ground, say at Banff, who would apportion the water and adjudicate between the users and he, through his several assistants, would actually carry out this process from day to day or week to week as the occasion might arise. These operations would apply to water for irrigation purposes as well as for power.

In addition to these duties of regulation, this Engineer would also be charged with continuing and collecting the various data and information already outlined consequent upon operation.

The cost of up-keep and maintenance of the works, as well as the expense of the actual operation of the regulation by the Government, can be apportioned yearly amongst the various users in the same manner as already outlined for repayment of the construction cost.

Recommendations.

In conclusion, and in accordance with the foregoing I have the following recommendations to offer as being designed to meet the general conditions:—

1. That the investigations on the Bow River basin be continued for the purpose of making the data more complete and useful in the subsequent operation of the project.
2. That the Government undertake the further construction of storage reservoirs and regulating works and provide for the repayment of their cost by means of annual rentals charged to users of water.

3. That a scheme for operating these storage reservoirs and for regulating and controlling the discharge of the river be adopted and put into practical working effect by the Government, and that the annual cost of same be charged to the users in the same manner as the original cost.

4. That as soon as the project is put into working effect (or sooner), the existing storage works at lake Minnewanka be acquired and its regulation and operation be taken over by the Government according to the terms of the existing agreement with the Power Company.

Yours very truly,

C. H. MITCHELL.

APPENDIX II

PROPOSED DAM AT SPRAY LAKES

REPORT BY

G. R. G. CONWAY, C.E.

REPORT PROPOSED DAM AT SPRAY RIVER, B.C.

(By G. R. G. Conway, C.E.)

Vancouver, B.C., April 6, 1914.

To J. B. Challies, Esq.,
Superintendent, Water Power Branch,
Department of the Interior,
Ottawa.

Proposed Dam at Spray River, British Columbia.

Sir,—In accordance with your request, I have reviewed the available data that you have obtained with regard to the possibilities of constructing a storage dam at the Spray River canyon in Alberta. The construction of a dam with a proposed maximum height of 160 feet in a place so remote from rail transportation involves the consideration of several points that are of extreme importance when considering the subject from the economical standpoint. The difficulties of access to the site and high cost of materials that may require to be transported to that site, makes it imperative to select a type of dam that while absolutely safe shall be constructed at the lowest cost. From careful consideration of the data available with regard to the proposed location, I believe, subject to further investigation as to the foundation conditions, that a dam can be safely constructed there either of concrete masonry, rock-fill, or of earth work, the latter either of the ordinary type or constructed by the hydraulic-fill method.

To determine the approximate cost of a concrete dam designed either as a gravity dam or one of the arch type, much careful exploration work by means of test pits and diamond drill borings is absolutely necessary; but after taking into consideration the high cost of cement and materials, and the difficulty of transporting the large amount of plant necessary for its construction a distance of 30 miles from the Canadian Pacific Railway, it is obvious that an approximate estimate, based upon reasonable assumptions with regard to foundation conditions makes it necessary to dismiss a proposal for a concrete dam from practical consideration. I have, though, made an approximate estimate of the cost of a typical gravity dam for the purpose of comparison with other types. From the general geological character of the canyon, the type of dam most suitable for the location is either one of a rock-fill type or an earthen dam, preferably of the hydraulic-fill type.

Rock-fill Dam.—A dam of the best rock-fill type, such, for example, as the Morena dam in California, is quite feasible and entirely suitable for the site, and satisfactory rock could be quarried at a convenient elevation so that the material could be handled by gravity at an economical figure. This type, however, involves the use of large quantities of concrete for obtaining a water-tight upstream face, and considerable plant to handle the rock economically, and, in addition, its construction would be prolonged over several seasons. An approximate estimate shows, too, that its cost is prohibitive.

Earth Dam.—From a consideration of the materials available at the site at a suitable elevation so as to be economically placed in the dam, I am of the opinion that a dam of the hydraulic-fill type which has been proposed is the most suitable and economical one to adopt.

This type has already been adopted in building two large dams in British Columbia, one a dam 1,000 feet long and 60 feet high at Bear creek, Vancouver island, for the Vancouver Island Power Company, where the construction of the dam had to be carried on in a very inaccessible region and under severe winter conditions, and the other a dam at the outlet of Coquitlam lake, for the Vancouver Power Company. The latter dam is 99 feet high and contains nearly 600,000 cubic yards of material. Both of these dams have been built of glacial drift, and in the case of Coquitlam a homogeneous dam of clay concrete of an excellent character was obtained. In my opinion the glacial clays of British Columbia afford the very finest material for constructing a satisfactory dam if the materials are graded with skill, and are infinitely superior to clays of a purer and richer character. From a consideration of the samples that were examined by Mr. G. L. Albert, it appears that a satisfactory grading of materials could be obtained for forming an impervious core. The chief difficulty, in my opinion, however, is in the apparent scarcity of heavy boulders for the outer slopes, a scarcity which may, however, be overcome by quarrying quantities of rock near the site for incorporation with the sluiced material.

In constructing a dam of the height proposed, which is well below the limit of the height of a number of other similar dams that have been successfully completed, great care must be taken to ensure the provision of ample rock toes of cyclopean rubble, and at the same time to limit the amount of fine impervious material in the centre of the dam only to what is necessary to ensure water tightness. In the construction of the Necaxa dam No. 2 in Mexico, a dam 190 feet in height, the preponderance of rich clays and fine impervious material was the cause of serious disaster, and in the reconstruction of that dam, as actually built, the rock toes were so heavy and massive that the proportion of impervious material was reduced considerably beyond that called for in the original design; in fact, the revised design differs in very many important essentials from that as originally published.[1] The lessons learned from the partial failure of the Necaxa dam are very instructive, and must be borne in mind in designing dams of the hydraulic-fill type.

The available materials for the hydraulic-fill at the Spray canyon appear to me to be eminently satisfactory for obtaining a properly graded fill throughout the major portion of the dam. The proportions of sand and gravel are such that a proper drainage of the interior mass can be obtained so that the stability of the whole can be secured. The material appears to be lacking in large boulders of rock, but the proximity to the dam location of an excellent site for quarrying limestone rock will enable large quantities to be secured if necessary at an economical cost for the outer or more porous section of the dam so as to increase its stability. From the general character of the rock, it would appear possible to break it up with black powder into comparatively small fragments and convey it by sluicing to the dam.

After carefully studying the available information, I have proposed in the sketch attached herewith the main outline of a suitable maximum cross-section of the dam. Further information should be available before the exact foundation conditions are settled, and I would recommend that a series of test pits be sunk along the centre line of the proposed dam.

The base of the dam for a distance of 400 feet along the river bed should be thoroughly cleaned to expose bedrock, and the whole of the site should be thoroughly cleared of all roots, stumps, and loose material, and a core wall of concrete, carried well into the bedrock across the river-bed and stepped up the side slopes, is, in my judgment, necessary to obtain a perfectly water-tight seal between the joint rock and the impervious material; but there is no necessity for this core wall being carried more than 4 to 6 feet high above the rock level.

[1] See page 243, Trans. Am. Soc. C.E., vol. lviii.

The provision of a centre core wall of the full height of the dam would not only involve a heavy expenditure, but would be unnecessary, and, in fact, dangerous, because of its interference with the proper drainage of the glacial material in a dam of the character proposed.

The only justification for core walls in hydraulic-fill dams is where there is a danger from burrowing rodents, and even in such cases reliance upon properly riprapped slopes would be more satisfactory, but I believe the danger of damage from burrowing animals at the Spray canyon site is not present.

In the Bear Creek dam, Jordan river, a satisfactory cut-off wall was obtained where the rock lay 30 to 40 feet below the surface, by the use of interlocking steel piles. In the Coquitlam dam a core wall about 4 feet high was constructed on the east bank, founded on the rock ledge, but this wall was not carried across the clay foundation. In the design which I have indicated, allowance has been made for heavy cyclopean rock toes, upstream and downstream, and if it was found economical to quarry rock, these toes could be increased considerably beyond the dimensions shown, with advantage.

In constructing the dam, two seasons will be required for the sluicing. In the construction of the Coquitlam dam 77,700 yards of material were sluiced into place during one month in a run of 528 hours, with a monitor pressure of 80 pounds per square inch, representing with a twenty hours' daily run, an average of 2,800 yards daily. The special conditions, however, existing at this dam permitted that quantity to be safely sluiced into the work owing to the massive proportions of the heavy cyclopean rock-fill toes and broad bases, but in the case of the dam at the Spray canyon, to obtain proper drainage of the materials, this speed should not be attempted, owing to the rapid increase of height which would be obtained in so short a dam. If the total quantity of material to be placed in the dam, amounting to approximately 500,000 cubic yards, excluding the rock toes, two shifts daily of ten hours each, at an average of 1,500 cubic yards, will mean eleven months' work distributed over two working seasons. It is advisable during the winter months to close down the work entirely, otherwise the cost would be excessive. I have proposed that the upstream slope should be heavily riprapped, and near the crest the riprapping should be grouted or laid in cement so as to prevent wave action (which will probably be considerable), from damaging the dam at high-water line. In addition to the diversion tunnel, I believe a spillway having a capacity of not less than 12,000 cubic feet per second should be provided on the west bank, as this quantity might have to be discharged under flood conditions with a full reservoir, and a possible accident at the intake tower at the same time. This spillway should be excavated down to the level of the rock, and if necessary a concrete wall carried across so as to bring it to the required level, and a channel excavated, or a retaining wall built, so as to prevent the water overflowing on to the downstream face of the dam. The exact location of the spillway and channel can be determined when locating the borrow pits so as to reduce the excavation as much as possible.

The design of the intake tower and the construction of the tunnel presents no difficulties. Duplicate sets of valves of the Stoney pattern similar to those in use at the Coquitlan-Buntzen tunnel can be easily adapted for control purposes.

I have given careful consideration to the cost of building this dam, and believe the hydraulic-fill type can be constructed at a considerably less cost than any other type. One of the principal items involved, viz., that of sluicing the hydraulic-fill, varies considerably in different dams. At Bear creek, Jordan river, where 160,000 cubic yards were placed in position by the hydraulic method, the cost, including plant, etc., amounted to 49½ cents per cubic yard; at the Coquitlam dam the labour cost varied in different months between ten cents and

twenty-two cents a cubic yard; the average labour cost, including the construction of flumes, their removal, etc., during the whole period of sluicing 450,000 cubic yards was 17 cents; the average cost, including plant, pumping, power (electric energy charged ½ cent per k.w.h.) and superintendence was 29 cents per cubic yard.

The convenient position of the borrow pits at the Spray Canyon site and the class of material, together with an available water power for a temporary hydro-electric installation, should make an estimate of 30 cents a cubic yard a sufficient one. This figure, however, may be a little low if it is found necessary to quarry rock to incorporate in the hydraulic fill at the outer slopes of the dam. I estimate that not less than 15 per cent of the quantities of material in the dam (exclusive of the rock toes) will require to be of large boulders or rock, say about 75,000 cubic yards.

For the cyclopean rock toes, the loose rock obtained in stripping the foundations in the centre of the dam and the excavations from the tunnel may be utilized to advantage. To the estimate in Mr. Hendry's report, I should prefer, to be on the conservative side, to add the sum of $44,000 to item No. 5 for heavy cyclopean rock toes, and with the available information which you have already obtained, I believe the sum of $558,000 as the cost of constructing the dam to be a reasonably approximate one, although the estimates may require revision upon fuller investigation and exploration work.

From estimates which I have prepared, the following is a comparative estimate of the cost of different types of dams:—

Concrete Dam	$1,350,000.00	$8.00 per acre-foot.
Rock Fill Dam (288,000 cu. yds.)	810,000.00	4.75 " " "
Hydraulic Fill Dam	558,000.00	3.25 " " "

Even if the above estimate for an hydraulic-fill dam is slightly exceeded, its cost will be very economical and reasonable, and will compare most favourably with that obtained by the construction of other high dams, and the available water storage will have been obtained at a much lower cost than has been obtained by the building of other storage dams in British Columbia and on the Pacific coast.

I recommend further explorations of the foundations, and believe it to be important to obtain a report from a competent geologist dealing with the stratigraphical features of the site and basin.

The proposal to build a dam at this site appears to be an excellent one, and from the information already available would appear to present no special engineering difficulties.

Yours faithfully,

G. R. G. CONWAY.

COMMENT ON MR. CONWAY'S REPORT BY MR. HENDRY.

In order that the effect of the increased cost of the Spray Canyon dam, as estimated by Mr. Conway, upon the cost of power from the several developments, may be seen, the following has been prepared:—

ESTIMATED COST OF DAM.

Roads, etc	$ 25,000.00
Temporary power plant	30,000.00
Preliminary, foundations, etc	40,000.00
Sluice tunnel and control	117,000.00
Dam, core wall, spillway, etc	165,000.00
Clearing	38,000.00
Engineering, contingencies and interest	99,000.00
Rock toes (as per Mr. Conway's report)	44,000.00
Giving a total of	$558,000.00

To the above should be added the charges due to engineering, contingencies and interest on $44,000, which amount to, say $12,000, giving a grand total of $570,000 as the cost of creating storage at Spray lakes.

The total estimated cost of creating storage on the Bow river sufficient to ensure a minimum flow of 1,500 c.f.s. would be as follows:—

Estimated cost Spray Lake storage	$570,000.00
" " Bow Lake "	105,000.00
" " Lake Minnewanka "	140,000.00
Total	$815,000.00

On the basis of a minimum flow of 1,500 c.f.s. the total continuous output of the river would be 47,300 w.h.p. Therefore cost of storage per w.h.p. is $17.23, in place of $16.03 per w.h.p. as per estimate in the report. The cost of power from the several plants under this increase is set forth in the following table:—

Plant.	Bow Fort.	Mission.	Ghost.	Radnor.
Cost of plant	$ 780,430.00	$748,100.00	$782,966.00	$711,100.00
Storage charges	155,070.00	110,445.00	117,500.00	103,400.00
Transmission, etc	86,400.00	64,700.00	70,577.00	62,400.00
Total capital cost	$1,021,900.00	$923,245.00	$971,043.00	$876,900.00
Annual charges	$ 117,518.00	$106,173.00	$111,670.00	$100,843.00
Annual charges per h.-p.	16.09	20.03	18.92	19.39
Annual charges per h.-p. on 50 per cent load factor	32.18	40.06	37.84	38.78
Annual charges per k.w. on 50 per cent load factor	42.91	53.41	50.45	51.71
Annual charges per k.w. on 50 per cent load factor under former estimate	42.48	52.98	50.09	51.33

From the above it will be seen that the increased estimated cost has very little effect upon the actual cost of producing power from the several plants.

APPENDIX III

PROPOSED DAM AT SPRAY LAKES

REPORT BY

GEO. L. ALBERT.

PROPOSED DAM AT SPRAY LAKES

(By Geo. L. Albert).

Banff, Alta., July 19, 1913.

Mr. M. C. Hendry, B.A.Sc.,
Chief Engineer, Bow River Survey.

Dear Sir,—According to the agreement made with you at Coquitlam dam, I beg to hand you herewith report upon the investigation made by me, during the past few days, into the feasibility of placing a hydraulic-fill dam in the canyon on Spray river below Spray lakes; also the suitability of the adjacent material to that form of construction.

Canyon and Formation.

The canyon is a deep, narrow gorge, formed in limestone, and evidently following the course of an old fault. I found that the bedding planes of the limestone on the west wall of canyon were lying nearly horizontal, east and west, and with a slight dip, or strike, south; the canyon wall on this west side rising to an elevation of about 160 feet above river-bed, and is very precipitous but not so nearly vertical as on the east side.

On east wall the bedding planes have been turned up nearly vertical, running north and south with, or paralleling, the river, and rising to an elevation of about 200 feet or more above the river-bed.

Dam Sites.

I first made a general examination of the canyon and selected three points for study and comparison, which I will distinguish by numbering as follows:—

Site No. 1, or Lower,
Site No. 2, or Middle,
Site No. 3, or Upper.

Site No. 1 is at the narrowest part of gorge, 1,000 or 1,200 feet downstream from the beginning of the canyon, with the center line of the proposed dam falling across the river through the center of the cliff. At this point it approximated very nearly to the site pointed out by you as the one having been selected. This site would require less material, likely, than either site No. 2 or site No. 3; but after a careful study and examination of the walls, I found that the west wall is shattered and seamy for some depth into the side of wall from top to bottom, necessitating expensive cleaning. The east wall is very clean on the face; but back in the wall from about 25 to 40 feet, the strata are badly seamed and parted, plainly showing the effects of the milling in the faulting; and the seams being partly refilled with hydrated fragments, and very porous, would make a good seal doubtful without a great deal of special work. Both rock walls rise to a sufficient height to admit of a dam of the proposed elevation, which is, I understand, approximately 160 feet.

Site No. 2 is 150 or 200 feet upstream from site No. 1, with all conditions as at site No. 1, except that all of the shattered material on the west side, and all of the seamed and hydrated materials on the east side have been torn off, and worked and slid away; so that little or no work would be necessary to secure an absolutely safe seal to a good bonding surface.

It is possible that the yardage may be slightly greater at this point than it would be at site No. 1; but this could be ascertained later on by measurements which I could not make at this time.

The problem of spillway involved would be the same at both sites, Nos. 1 and 2. They are simple, as you know, and very natural. The cleaning of the river-bed also would be about the same; and with the surface indications, and what examination I was able to make at this time, I have no doubt that a good tight bottom could be easily reached. Also, the diversion of river water, etc., would be equal.

Site No. 3 is still further upstream, being at the upper end of the canyon. A good foundation can no doubt be had there, and the height of dam would be reduced some 15 or 20 feet. On account of the dip of the rock formation to the south on the west side, the solid rock would not be high enough for spillway floor; also, there would likely be a porous stratum between the surface of the rock formation and the overlying glacial material on this side. As it necessitated more exploration work than I was able to give it at this time, I accordingly abandoned it for the present.

After careful consideration and comparison of the best points along the canyon, I have selected site No. 2 for recommendation, the reasons being as follows:—

First.—The problem of foundation in the present river-bed would be equal at all points along the gorge, no doubt.

Second.—The preparation and cleaning for foundation and bond along the entire centre line above the present river-bed involves very much less expense at site No. 2 than at any of the other points, and this site indicates a very much more perfectly solid foundation free of all seams.

Third.—Considering the profile along the centre line, across a deep, narrow gorge, as this gorge is, it would be the flatter at site No. 2, which is of considerable value to the poise, or rest, of the hydraulic material; for the reason that there is much less tendency of the material in the final drying out and shrinking, to curl or break the bond with the solid formation at or near the top of fill, on the flatter profile, than there would be with the nearly vertical walls, as at site No. 1.

Fourth.—The work involved in creating a spillway and providing for river diversion would be the same at sites 1 and 2.

Material for Sluicing.

The solid limestone formation on both sides of the canyon is covered by a glacial material, principally of disintegrated limestone hydraulically deposited to varying depths, and over an extensive area. On the east side, at sites 1 and 2, the bedrock rises to a much greater elevation than on the west side. The deposited material is much thinner here, but ample and available.

On the west side, the deposit of material is from 80 to 100 feet deep; is easily available and ample; and apparently contains clay, sand, fine and coarse gravel, cobbles and boulders, in very desirable proportions to meet the requirements of an hydraulic-fill. It is composed of disintegrated limestone, its natural gravity corresponding to the limestone, which has a very heavy gravity—about 2.7.

Therefore it is my opinion that a dam with slopes of 2 : 1 on back side, and 3 : 1 on water side, with a 35-foot or 40-foot crest, would make an absolutely safe, stable, impermeable fill, safely and economically adapted to this particular location.

Classification, location, and explanation of samples of materials taken at various points in the basin below the lakes and on down to the sites:—

The samples were taken from excavations I made into the materials at many

points; the samples being panned or washed in water in such a manner as to separate and grade the material, showing approximately the percentage of the fine and coarse material combine.

Commencing at the lake on both sides, I made a very careful examination of all material from river level to the top of the hills, and on below sides, by making many test holes, and only taking samples where a marked difference in class would show. As generally taken, the material was sufficiently uniform to be judged, as a whole, as almost ideal material for the work proposed. As previously stated herein, the deposits being much deeper on the west side than on the east side, and consequently being at a lower level on the west side, the percentages of clay and fine sand are greater than on the east side; more particularly so near bedrock, the coarser materials lying nearer the top. The great depth of the deposit and very convenient location suggests the west side for the choice of borrow pits.

The percentages given below of the various samples do not show accurately the proportions as found in each small sample of about one-half cubic foot of the material washed; but gives very closely the proportions of the aggregate at the place of taking, considered as deposited in an hydraulic-fill.

I have delivered to you two samples of the best clay and sand deposit, which I would suggest that you have tested. The sample of the pulverized material is from an exposed bank of clay on west side, and about 300 feet upstream from site No. 2. It is off the surface, and is principally clay and fine sand. The solid sample is from an excavation made in an old slide near the upper end of canyon on west side. I estimated that it contained about 15 per cent of moisture when first taken out, and about 60 per cent of clay and fine sand, and about 25 per cent of coarse sand and gravel.

This material alone would give more puddle material than would be necessary; but estimating the whole deposit as taken in the construction, there is sufficient of all grades to make it especially good.

The tests of all samples on west side, taken near bedrock, showed about as these samples:—

Moisture	.15
Clay and fine sand	.60
Coarse sand and gravel	.25
	1.00

The samples taken at from 25 to 40 feet above bedrock were much coarser, and, not considering moisture, showed as follows:—

Clay	.30	
Fine sand	.10	
Coarse sand	.15	
Gravel	.25	West Side.
Cobbles and boulders	.20	
	1.00	

The samples taken at and near the top of deposit showed:—

Clay	.10	
Fine sand	.10	
Coarse sand	.20	
Gravel	.25	West Side.
Cobbles and boulders	.35	
	1.00	

Of the samples tested on east side along the top wall of canyon, above sites 1 and 2, the material near bedrock was of about the same uniformity, averaging about:—

Clay	.20	
Fine sand	.10	
Coarse sand	.20	
Gravel	.25	East Side.
Cobblestones	.25	
	1.00	

Samples taken at slide just below lake showed very little clay and fine sand, or about:—

Clay	.03
Fine sand	.05
Coarse sand	.10
Fine gravel	.25
Coarse gravel	.50
Cobbles	.07
	1.00

Conclusion.

Examination and tests of all materials show them to be of very first-class quality for building a first-class hydraulic-fill dam of height required.

Dam site location No. 2 is absolutely beyond question.

There is timber available for trestles, and most other necessities.

There is water under sufficient head to provide ample power, and very handily.

Construction of road for transportation not excessive.

In my opinion it is altogether a first-class scheme, and I can very readily recommend it.

Awaiting your acknowledgments, I beg to remain,

Yours faithfully,

GEO. L. ALBERT,
Supt. of Construction, Lake Coquitlam dam, also Canyon Creek dam, Lake Francis dam, Acatlan dam, Laguna dam, Los Reyes dam, and others.

APPENDIX IV

RESULTS OF ANALYSIS OF SLUICING MATERIAL

REPORT BY

FRANK T. SHUTT, M.A., F.I.C., D.S.c., *Dominion Chemist.*

RESULTS OF ANALYSIS OF SLUICING MATERIALS.

(Frank T. Shutt, M. A., F. I. C., D. Sc., *Dominion Chemist.*)

Central Experimental Farm,

Ottawa, August 21, 1913.

J. T. Johnston, Esq.,
Hydraulic Engineer, Water Power Branch,
Department of the Interior,
Ottawa, Ont.

Re "Hydraulic Fill," Laby. Nos. 15364-5.

Dear Sir,—The two samples of "fill" forwarded with your letter of recent date, have been submitted to mechanical analysis and the following results obtained:

Sample A.—A hard conglomerate of gravel, sand and clay, in large lumps. Readily disintegrates in water.

Sample B.—Chiefly in small lumps and consisting of sand and clay with small stones.

Analysis of Fills.

No.	Type.	Obtained by.	Size of Particles.	Percentage	
				A.	B.
			Mms.		
I.	Coarse gravel and stones	2 mm. sieve	2 to 200	23·80	18·64
II.	Fine gravel	1 mm. sieve	1 to 2	4·71	3·57
III.	Coarse sand	·5 mm. sieve	·5 to 1	3·27	2·53
IV.	Fine sand	Rapid settlement	·05 to ·5	19·07	15·33
V.	Silt, with fine sand	Slower sedimentation.	·005 to ·05.	9·75	7·64
VI.	Clay	By difference	·0005 and finer to ·005	39·40	52·29

Under separate cover we send specimens of the types mentioned in this table (with the exception of VI), as obtained from "A." These will probably enable you the better to comprehend the character of the various components into which we separated the material.

Yours faithfully,

FRANK T. SHUTT,
Dominion Chemist.

APPENDIX V

THE GEOLOGY OF THE BOW RIVER BASIN

BY

CHARLES CAMSELL, B. Sc., Ph. D.

THE GEOLOGY OF THE BOW RIVER BASIN

(By Charles Camsell, B.Sc., Ph. D.)

INTRODUCTORY STATEMENT.

The information contained in this portion of the report is compiled wholly from reports of officers of the Geological Survey, and mainly from those of Dawson, McConnell, Cairnes, Dowling, and Allan. Much of it is copied verbatim from the Guide Books prepared by J. A. Allan and D. B. Dowling for the International Geological Congress in 1913.

The following reports deal more fully with the geology of certain portions of the Bow River basin:—

Dawson, G. M.—Preliminary report on the Physical and Geological Features of that portion of the Rocky mountains between latitude 49° and 51° 30′. Geol. Surv. of Can., vol. 1, part B, 1885.

McConnell, R. G.—On the Geological Structure of a portion of the Rocky mountains, Geol. Surv. of Can., vol. 2, part D, 1886.

Dowling, D. B.—Report on the Cascade Coal Basin. Geol. Surv., Can., No. 949.

Cairnes, D. B.—Report on the Moose Mountain District, Geol. Surv., Can., No. 968, 1907.

Allan, J. A.—Rocky Mountains—Guide Book No. 8, part 2, page 167.

Dowling, D. B.—Winnipeg to Bankhead, Guide Book No. 8, part 1, page 77.

General Physical Features.

The basin of Bow river west of Calgary lies on the eastern slope of the Rocky Mountain system, between latitude 50° 30′ and latitude 51° 45′. In this basin are three distinct types of topographic form, the western, including the rugged alpine region of the eastern ranges of the Rocky Mountain system, the middle covering the more rolling foothills region, and the eastern the level plains region about Calgary.

The Rocky mountains here, as elsewhere, are made up of a series of parallel ranges striking about N. 30° W., and coinciding more or less closely with the general trend of the main mountain system. Between the ranges are deep longitudinal valleys whose positions have been determined by the presence of belts of softer rocks. Crossing the ranges here and there at right angles are a number of transverse gaps through which the larger streams break on their way eastward to the plains. The pattern produced by this system of drainage is that of a series of oblong, rectangular blocks, the longer directions of which are parallel to the trend of the mountain axis, while the shorter are at right angles to it.

The origin of the longitudinal valleys is directly connected with the origin of the mountains themselves. The transverse valleys, however, may represent portions of very old drainage systems which existed previous to the elevation of the mountains, or they are due to erosion of the streams along lines of weakness or fracturing developed during the period of mountain building.

Bow river is in some places longitudinal and in others transverse. For example, from Laggan down to Sawback it occupies a longitudinal valley that

has been cut out by the stream along the crest of a fold in the strata. From Sawback it turns eastward and as far as Bankhead occupies a transverse break across the strike of the bedrock and across the trend of the ranges. It then reaches a belt of soft rocks which deflects its course again southeastward down a longitudinal valley until below Canmore it again turns at right angles and breaks through the outer ranges into the foothills region.

The loftiest summits of these ranges are those about the main divide, where several individual peaks are more than 11,000 feet above sea-level. A number of mountains exceed 10,000 feet and whole ranges and groups of peaks surpass 8,000 feet.

The type of mountain most commonly developed in the Bow River basin is that with a steep escarpment on the east side and a longer easy slope on the west side. This feature, like that of the longitudinal valleys, can be attributed to elevation of the mountains by thrust from the west, the strata having been folded and overturned, or broken and overthrust on each other. Erosion then produces the steep eastern slope, while the easy western slope represents the original dip of the strata. Where the summits are composed of horizontal beds of massive limestones the easy breaking of the beds along joint planes at right angles to the bedding produces mountains of which the upper parts are sheer cliffs. A later stage in decay of these mountains results in chimney or spire-like peaks. Where the limestone beds have been turned completely on edge as in the Sawback range the massive character is replaced by straight narrow crests and saw-like outlines.

The break between the mountains and the foothills is sharp and distinct and marked by the abrupt escarpment-like front of the Rocky mountains.

The foothills region is characterized by a group of long ridges or hills arranged in linear series, the positions of which have been determined by zones of harder rocks. The trend of the ridges is the same as in the main ranges, and to a certain extent the same general drainage pattern holds.

The summits of the ridges are generally rounded and flowing, except where crested with ledges of sandstone. While the disturbance of the bedrock in the foothills is not less than that found in the mountains the more subdued topographic outlines of the former are due to their being composed of much younger and softer rocks which are less resistant to the action of erosion and denudation.

Topographically the foot-hills region merges gradually into prairie region on the east, the open rolling character of which is due primarily to the almost undisturbed attitude of its underlying bed rock.

Stratigraphy.

The rocks of the Bow River basin above Calgary contain representatives of almost every age from Pre-Cambrian to Recent, or from the oldest to the youngest. They are all stratified rocks and the sequence is exposed in descending order from east to west, the strata about the main divide being the oldest. The missing formations are those of the upper part of the Tertiary, the Silurian and the Ordovician. The last two mentioned, however, appear on the western slope of the Rocky mountains.

The following table, mainly after Allan, presents the geological formations in summarized form with the approximate thicknesses and lithological character of each:—

Table of Formations.

System.	Formation.	Approx. Thickness.	Lithology.
		Feet.	
Recent and Pleistocene	Fluviatile		Gravel, sand.
	Lacustrine		Gravel, sand, clay, silt and conglomerate. Till.
	Glacial. (Erosion surface).		
Tertiary	Paskapoo	5,700	Yellowish sandstones and bluish gray and olive sandy shales.
Cretaceous	Edmonton	700	Light coloured, soft sand-stones, shales and clays.
	Pierre	1,000	Dark gray or black shales (Bear paw shales); light coloured sandstones, shales and clays (Belly River beds); and dark shales (Claggett shales).
	Niobrara	200	Sandstones and shales (Cardium).
	Benton	725	Dark gray or black shales.
	Dakota	950	Sandstones and conglomerates.
	Kootenay	3,700	Massive and thin bedded sandstones, shales and coal seams.
Jurassic	Fernie shale	1,500	Dark brown to black arenaceous shale; weathers into lens-like fragments.
Permian	Upper Banff shale	1,400	Dark brown arenaceous shale weathering reddish and yellowish.
Mississippian	Rocky Mountain quartzite	800	White to gray quartzite and arenaceous siliceous limestone.
	Upper Banff limestone	2,300	Thick-bedded dark gray limestones with numerous thin cherty layers underlain by thin-bedded limestone and shale weathering gray.
Pennsylvanian	Lower Banff shale	1,200	Black to dark gray shale, argillaceous and calcareous; weathering light brown.
	Lower Banff limestone	1,500	Thick-bedded gray limestones with numerous dolomitic segregations.
Devonian	Intermediate limestone	1,800	Thin-bedded limestones with alternating more massive layers of gray dolomitic and siliceous limestone.
	Sawback limestone (age?)	3,700	Thin-bedded limestone inter-bedded with less resistant layers and brownish and yellowish shale.
Contact relations not known.			
Upper Cambrian	Ottertail limestone	1,725	Massive blue limestones with cherty and shaly bands.
	Chancellor	4,500	Thinly laminated gray argillaceous and calcareous metaargillites and shales; weathering reddish, yellowish and fawn; underlain by highly sheared gray shales, slates, argillites and phyllites in Ottertail valley.
	Sherbrooke	1,375	Thin-bedded colitic arenaceous o dolomitic limestones.
	Paget	360	Massive bluish gray limestones, with colitic bands of dolomitic limestone.
	Bosworth	1,855	Massive gray arenaceous and dolomitic limestone; weathering yellowish buff; inter-bedded with greenish siliceous shale; weathering red, yellow, purple.

TABLE OF FORMATIONS.—*Concluded.*

System.	Formation.	Approx. Thickness.	Lithology.
		Feet.	
Middle Cambrian	Eldon	2,728	Massive-bedded arenaceous limestones forming cliffs and castellated crags.
	Stephen	640	Thin-bedded limestone, and shale; includes "Ogygopsis shale" in Mt. Stephen and "Burgess shale" in Mt. Field.
	Cathedral	1,595	Thin-bedded arenaceous and dolomitic limestones.
Lower Cambrian	Mt. Whyte	390	Siliceous shale, sandstone and thin-bedded limestone.
	St. Piran	2,705	Ferruginous quartzitic sandstone.
	Lake Louise	105	Compact grayish siliceous shale.
	Fairview	600	Ferruginous quartzitic sandstone. Local basal conglomerate and coarse-grained sandstone.
Conformable in some places.			
Pre-Cambrian	Hector	4,590	Gray, green and purple siliceous shale with conglomerate interbedded.
	Corral Creek	1,320	Quartzitic and coarse-grained sandstone with shale interbedded.

PRE-CAMBRIAN.

The Pre-Cambrian rocks are distributed along the floor and sides of Bow River valley from the base of Castle mountain to the head-waters of the stream. The lower part, known as the Corral Creek formation, consists of grey sandstone underlain by a coarser quartzitic sandstone which in turn rests on a conglomerate. The upper part, or Hector formation, consists mainly of grey, purplish and greenish shale, with which are interbedded bands of conglomerate.

LOWER CAMBRIAN.

The Lower Cambrian rocks form the base of Castle mountain and are exposed above the Pre-Cambrian on the western slope of Bow Valley from Vermilion creek to the head-waters of Bow river.

The Fairview formation consists of brown and white quartzitic sandstone. Locally there is a basal conglomerate on the Pre-Cambrian shales containing rounded pebbles of white quartz in a cement of quartz, feldspar and mica. The basal rock is more frequently a coarse sandstone with rounded and angular grains of quartz and feldspar. Some of the quartz grains have a glassy, almost opalescent, colour.

The Lake Louise formation, as the name suggests, is best exposed at lake Louise. The formation has a total thickness of 105 feet and consists of a ferruginous siliceous shale. It weathers more readily than the beds below or above, so that the slopes in it are more gradual.

The St. Piran formation consists of massive-bedded, ferruginous quartzitic sandstone, with a total measured thickness of 2,705 feet. These beds form steep escarpments wherever they are exposed. On the west side of mount Victoria the cliffs composed of these beds are over 2,500 feet high. The brown colour of the rock is due to smoky quartz and small particles of mica in the cement.

In sharp contrast with the underlying massive quartzites, there is a thin series of siliceous and calcareous shales grouped as the Mount Whyte formation. These shales are less resistant than the quartzite and form gradual slopes. Some of the layers contain numerous annelid borings and trails.

Middle Cambrian.

The Middle Cambrian consists of massive limestones and some shaly limestone and calcareous shale. It forms the steep escarpment of the upper part of the Castle mountain and occurs again on the summit of the main divide in the Bow range and the Waputik mountains.

The Cathedral formation consists of massive and thin-bedded dolomitic limestone, which on the weathered surface becomes buff and grey. The more massive beds are arenaceous in their composition. The Monarch mine, in mount Stephen, and other small mineral prospects in the Kicking Horse valley, are in this formation.

Some of the limestone has become metamorphosed into marble. One of the best exposures of this rock is in Cathedral mountain, 4 miles east of Field.

The Stephen formation is only 640 feet thick, but it is important for the number and variety of fossils which it contains. It consists of shaly limestone and calcareous shale. These beds include the "Ogygopsis shale" in mount Stephen, and the "Burgess shale" in mount Field, on the opposite side of the valley. The former includes the widely known trilobite-bearing "fossil bed," while the latter includes the new "fossil bed" discovered by Dr. C. D. Walcott in 1910.

The Eldon formation has a thickness of 2,728 feet in Castle mountain. It consists essentially of massive-bedded, arenaceous limestones, which form steep castellated crags on the erosion surface, thus making the formation readily recognizable wherever exposed. It is this formation which forms the steep escarpment about the upper part of Castle mountain.

Upper Cambrian.

The Bosworth formation of the Upper Cambrian is exposed in the mountain of the same name on the continental divide. It consists largely of thin-bedded limestone with a few more thick-bedded layers, interbedded with siliceous and arenaceous shale. One band of shale makes a good horizon-marker because it weathers greenish, yellowish, deep red and purplish.

The Paget formation is a band of greyish oolitic limestone, typically exposed in Paget peak, on the west slope of mount Bosworth. These beds can not be readily distinguished from the underlying limestone.

The Sherbrooke formation consists of arenaceous limestone at the base, overlain by thin-bedded limestone, including some oolitic and shaly layers. This formation includes the highest beds exposed in the Bow range in the vicinity of Hector pass.

The remaining Cambrian formations, the Ordovician, and the Silurian, are all exposed in the western portion of the Rocky mountains between the Bow range and Columbia valley, and are not present in the basin of Bow river.

Devonian.

The Devonian occurs in a number of bands which trend in a direction parallel to the axis of the mountains. One band crosses the Bow Valley at the Gap, and another at the western end of Lac des Arcs. A third band overlies the Cretaceous shales on the west side of Bow valley from Canmore to Bankhead. Other bands occur in the Vermilion lake and Sawback ranges.

The Intermediate Limestone consists of thin-bedded limestones alternating with harder layers of grey dolomitic and siliceous limestone, which on the weathered surface becomes banded. In the Sawback, Vermilion lake, and Cascade ranges it is exposed where reversed faulting has caused repetition.

The thermal sulphur springs at Banff occur in the intermediate limestone. The rock is high in sulphur, derived by decomposition from the pyrite which the limestone contains; a strong odour of sulphide of hydrogen is given off when the rock is struck with a hammer.

The upper limit of this formation is not clearly defined as it is transitional into the Lower Banff shale.

Sawback formation, underlying and conformable with the Intermediate limestone is a series of massive and thin-bedded dolomitic limestone and shale, which McConnell has placed in the Cambrian. These beds form a wedge-shaped band in the Sawback range and lie between mount Hole-in-the-wall and mount Edith, with a broader exposure along the north side of the Bow valley. It has been possible to measure and estimate a thickness of about 3,700 feet, but the actual thickness is believed to be much greater. The beds differ lithologically from the Cambrian beds in Castle mountain, which are largely Middle Cambrian, and from the Cambrian in the Bow range and to the west of this range. The age of the formation is still in doubt, but it is older than the Intermediate limestone, which is definitely known to be Devonian in age. These beds are lithologically closely related to some of the Silurian beds in the Beaverfoot range to the west.

Mississippian.

The Lower Banff limestone has been mapped as Mississippian, but it grades into the Devonian below, and has recently been proved to be largely of that age. The beds consist of massive-bedded grey limestone which forms steep escarpments wherever exposed on the slopes of a mountain.

This limestone forms the eastern cliffs of Cascade mountain and mount Rundle, and the steeper eastern slopes of Sulphur mountain. Some beds are fossiliferous, and the formation is characterized by numerous fossil-like dolomitic segregations.

The Lower Banff Shale consists of about 1,200 feet of shales. These shales are black to dark grey in colour, and weather brown. They are usually calcareous in composition, but certain layers are argillaceous and arenaceous. The lower contact of this series is sharply defined but at the top of the series the beds change to a shaly limestone difficult to distinguish from the overlying limestone. The shales weather out more easily than the limestone, so that a depression is always formed where these shales cut across a ridge.

Pennsylvanian.

The Upper Banff limestone contains over 2,300 feet of beds, which are well exposed in Sawback and Cascade ranges. The series is shaly at the bottom, but more massive towards the top. Cherty lenses and cherty shale interbedded with the lower shaly limestone help to distinguish this formation from the shales below.

The Rocky Mountain quartzite lies directly on the Upper Banff limestone. It represents a very sudden shallowing of the water, which, however, was not rendered muddy. The section in the Sawback range gives 800 feet as a maximum thickness. There is a rapid thickening of this formation to the east so that at lake Minnewanka, 12 miles to the east, there are 1,600 feet of quartzite exposed.

This is the uppermost formation in the Carboniferous.

Permian.

The Upper Banff Shale lies conformably upon the Rocky Mountain quartzite and consists of a series of brown, calcareous and arenaceous, often sun-cracked shales, interbedded with thin layers of sandstone. The shales weather out more easily than the underlying formations, forming valleys such as those between the Cascade, Vermilion lake, and Sawback ranges. More than 1,400 feet of strata are represented in this section, but it is difficult to get an accurate measurement on account of the foldings and contortions within the beds.

Jurassic.

Fernie Shale.—No sharp line can be drawn between the Upper Banff shale and the Fernie shale, except where fossils are found. The Fernie formation consists of black and dark brown, siliceous, very thinly laminated shales which break up into small fragments on the weathered surface. On the Cascade river it contains some gray sandstone beds and an occasional limestone layer. West of Banff it has a limited distribution, lying on the Upper Banff shale. East of Banff and on the north side of the Cascade trough, it forms a band about 1,500 feet thick. The Fernie shale occurs near Exshaw 6 miles east of the Gap.

Cretaceous.

The Cretaceous formations occur mainly in the foot-hills region from Kananaskis to Cochrane. A narrow band occupies what is known as the Cascade trough and extends from the head-waters of Cascade river down the Cascade and Bow valleys to Canmore and southward in that same direction across the upper part of Kananaskis river. In the foothills the rocks are of the same character and are so soft compared to the older rocks that they either floor the valleys or produce a type of country that is more subdued in form than that of the mountains.

Kootenay.—The lowest member of this formation rests upon the Jurassic in the Rocky mountains, and forms the bottom of the Cascade trough. The base of the formation consists of alternating beds of sandstone and shale, which are succeeded by sandstones and shales and many coal seams.

The upper part of the formation consists of thin-bedded sandstones and shales exposed in the eastern base of Cascade mountain. Near Banff the total thickness of this formation is over 4,000 feet.

Dakota.—In the mountains the coal-bearing Kootenay formation is overlaid by a series of sandstones and conglomerates containing thin seams of coal. In the foot-hills the sandstones are finer grained and are associated with some clays and shales. The thickness in the foot-hills is about 950 feet.

Benton.—This is a series of dark marine shales so soft and pliable as to be easily folded and distorted. They weather easily so that the outcrop is usually masked or marked by a depression.

Niobrara.—This formation is correlated with the Cardium sandstone, a formation which is important as forming the series of falls and rapids on the Bow river below Kananaskis. It consists of three sandstone beds, each capped by a conglomerate and separated by shales. A detailed diagrammatic section of this formation is given under the heading of "Bow Fort," in a later section of this report.

Pierre.—Marine deposits containing some calcareous matter overlie the Niobrara. They consist mainly of dark shales with some sandy beds in the middle. They occur in the foot-hills region and are exposed in the valley of Bow river below Bow Fort, where they have been folded into a series of anticlines and synclines and faulted.

Edmonton.—The Edmonton formation consists of light coloured, soft sandstones, shales and clays, well bedded and frequently alternating. The sandstones predominate and usually weather to a yellow colour. The shales are of various dark shades of colour. Some coal seams are present. The formation is not as highly disturbed as the older Cretaceous beds, and is the bed rock formation of Bow valley from Radnor to Mitford.

Tertiary.

Tertiary rocks under the name of the Paskapoo formation overlap the Cretaceous at Cochrane and extend from there eastward to Calgary. They consist of yellowish sandstones and bluish grey and olive shales. They have not been greatly disturbed since they were laid down and still lie in almost horizontal attitudes in contrast to the older rocks which have in general been tilted at high angles.

Pleistocene.

A thin veneer of unconsolidated material covers the surface of the solid rocks nearly everywhere except on the higher levels of the region. This unconsolidated material includes river deposits of gravel and sand, which appear as terraces about the sides of the larger streams, clays which were laid down in post-Glacial lakes, and glacial debris such as moraines and boulder clay.

Geological Structure.

There are four different types of geological structure developed in the rocks of the Bow river basin. The first is that of the almost flat lying rocks of the region east of Cochrane where the beds have been very slightly disturbed from their original attitude. In the foot-hills pressure from the west has thrown the beds into a series of irregular major folds and minor crumples which have their axis parallel to the general trend of the mountains. In many cases the beds are broken and faulted along lines parallel to the folds.

The eastern ranges of the Rocky mountains are characterized by a series of great longitudinal fractures along which the strata have been broken, tilted and shoved one over the other towards the east. The result is a series of fault blocks having a steep face to the east and a more gentle slope to the west. The western slope of these fault blocks represents the dip of the beds. In the ranges about the head waters of Bow river the disturbance is not as great and the strata are not as closely folded and are traversed by fewer faults. The beds in consequence have lower dips and horizontal attitudes are not rare.

Geological History.

The Rocky Mountain region in the neighbourhood of Bow river was a region in which sediments were being laid down almost without interruption from Pre-Cambrian times to the close of the Cretaceous. The region formed part of a great interior sea whose shore line fluctuated from time to time, but which was gradually pushed eastward towards the plains. By the close of Cretaceous times a great thickness of sediments had been laid down, the materials for which had been derived from a land area to the west. Sedimentation continued even into the Tertiary, but after the Paskapoo sandstones had been laid down, movements in the earth's crust which had already been felt along the line of the continental divide, culminated in a revolutionary period of mountain building during which the Rocky mountains were formed. The force which caused the elevation of the Rocky mountains was directed from the Pacific, and in

the course of mountain building the strata were arched upward, compressed and overturned on each other, and up-folded portions were pushed miles to the eastward over the level plains region.

The subsequent history of the region was in general one of erosion, that is to say, the carving out of its valleys by the streams and the development of its drainage system and a general wearing down of the mountain ranges.

GLACIATION.

During the Glacial period the Canadian Cordillera is believed to have been covered by an ice cap much as that which covers Greenland or the Antarctic continent to-day. This ice cap extended from the 48th to the 63rd parallels of latitude, or a distance of about 1,200 miles. During the maximum period of glaciation, the interior ice cap was fed by a double row of valley glaciers, one flowing eastward from the Coast range and another westward from the Rockies; the united stream then moved southward and northward over the interior of British Columbia. The eastern slope of the Rockies was also drained by eastward-moving valley glaciers which became confluent as piedmont sheets on the plains of Alberta.

In the basin of Bow river all the valleys were occupied during the glacial period by valley glaciers moving slowly down grade toward the east. These valley glaciers, by the aid of rock fragments along the bottom of the glaciers, deepened and broadened the valleys and gave them the general outlines that they have to-day. As the glaciers dwindled and retreated up the valleys they left large quantities of loose materials in their train. At certain points glacial lakes, dammed by ice tongues, were formed which received sediments in the form of clays and sands. Towards the heads of the valleys basin-shaped cirques were gouged out of the solid rock by means of mountain glaciers, the remnants of larger valley glaciers.

SPRAY LAKES.

Spray lakes lie in a transverse valley, which cuts across the general trend of the mountain axis and which separates the Goat range from Kananaskis range. The valley was probably at one time the main course of Spray river, but having been filled with glacial material the stream became diverted and the valley is only now occupied by a tributary of the main river. The lakes are stated by Dawson to be due to damming of the outlet by glacial materials or débris washed down from the bordering mountains.

The part of the valley which it is proposed to utilize as a storage basin is underlain by rocks of Palæozoic age Devonian and Carboniferous—consisting mainly of limestones with some quartzite and possibly shale. The strata have been tilted, and on the northeast side of Goat range dip at angles of about 45° to the southwest. On the west side of the Goat range the dips average about 60° in the same direction. The strike of the outcropping edges of the strata coincides roughly with the trend of the mountain axis, so that on the transverse portion of the valley at Spray lakes the strike is directly across the valley, while in the main valley of Spray river below Spray lakes the strike is parallel to the valley. At the point then where it is suggested the site of the dam should be the strike of the rocks is in general parallel to the course of the stream, and the rocks themselves consist of limestone and quartzite.

At Spray falls a ledge of pale grey limestone crosses the river, making a drop of 40 feet. The remainder of the proposed storage basin is covered with unconsolidated glacial and stream deposits which rest with a variable thickness on the upturned edges of the solid rocks.

KANANASKIS FALLS.

Kananaskis falls are caused by outcropping ledges of Cretaceous sandstone, known as the Cardium sandstone. The sandstone beds are from 50 to 150 feet in thickness and are overlain and underlain by shales. Cairnes describes the Cardium sandstone at this point as follows: "The lowest bed is a very hard sandstone, weathering to a reddish colour and is fairly well bedded. The bed next above is grey in colour on a freshly-fractured surface, is very massive, hard, and even quartzitic. There is a conglomerate bed 1 foot thick on top of each of these two lower sandstones. The upper sandstone is here also quite hard and weathers to a reddish colour."

The sandstone beds dip westward or upstream about 20°, and strike across the course of the stream.

HORSESHOE FALLS.

Horseshoe falls are caused by an outcropping ledge of sandstone of the Cardium sandstone formation, the character and structure of which has been described under Kananaskis falls.

BOW FORT.

For ten miles below the site of Bow Fort the Cardium sandstone formation is exposed in the banks of the river. The attitude of the beds is almost horizontal. Above Bow Fort the shales below the Cardium sandstone are brought up to the surface in a low anticline, the western limb of which is just below the Horseshoe falls. The shales are of Benton age, dark in colour, and soft. They weather down readily and are easily folded and distorted.

The Cardium sandstone formation near Bow Fort was carefully measured by Cairnes who gives the following section:—

Section of the Cardium Sandstones measured near Old Bow Fort, on the Bow river.

DARK PIERRE-LIKE SHALES.

CLAGGETT SHALES

UPPER SANDSTONE BED.

GREYISH AND GREYISH GREEN, FINE-GRAINED SANDSTONES, WEATHERING TO A REDDISH COLOUR. THE INTERCALATED SHALES ARE NEARLY BLACK, SOMEWHAT CALCAREOUS THROUGHOUT

70′

DARK PIERRE-LIKE SHALES

WITH A FEW CALCAREOUS SANDSTONE BEDS 6 INCHES TO 1 FOOT WIDE NEAR THE TOP, WHICH ARE VERY REGULAR, PERSISTENT AND NOTICEABLE.

60′

CARDIUM SANDSTONES

MIDDLE SANDSTONE BED.

THIS HAS 18 INCHES OF CONGLOMERATE ON TOP. VERY HARD, QUARTZITIC, MASSIVE SANDSTONE BED. PRESENTS SOMEWHAT OF A BLUE APPEARANCE

30′

DARK PIERRE-LIKE SHALES.

20′

LOWER SANDSTONE BED

WITH CONGLOMERATE ON TOP. WEATHERS TO A REDDISH COLOUR. CONSIDERABLE AMOUNT OF DARK SHALES INTERCALATED. FINE-GRAINED. RATHER HARD, GREYISH SANDSTONE.

40′

DARK PIERRE-LIKE SHALES.

BENTON SHALES

APPENDIX VI

WATER-POWER REGULATIONS UNDER THE DOMINION LANDS ACT, SEC. 36, S.S. 2.

WATER-POWER REGULATIONS UNDER THE DOMINION LANDS ACT, SEC. 36, S.S. 2.

Regulations made by His Excellency the Governor General in Council in virtue of the provisions of subsection 2 of section 35 of the Dominion Lands Act, 7-8 Edward VII, chapter 20, as amended by Section 6 of Chapter 27, 4-5 George V, to govern the mode of granting water-power rights in the provinces of Manitoba, Saskatchewan and Alberta, and the Northwest Territories.

SECTION 35.—DOMINION LANDS ACT.—WATER-POWER.

35. Lands which are necessary for the protection of any water supply or lands upon which there is any water-power, or which border upon or being close to a water-power will be required or useful for the development and working of such water-power, shall not be open to entry for homestead, for purchased homestead, or pre-emption, or be sold or conveyed in fee by the Crown, but may only be leased under regulations made by the Governor in Council.

2. Subject to rights which exist or may be created under the *Irrigation Act*, the Governor in Council may make regulations: (*a*) for the diversion, taking or use of water for power purposes, and the granting of the rights to divert, take and use water for such purposes, provided that it shall be a condition of the diversion or taking of water that it shall be returned to the channel through which it would have flowed if there had been no such diversion or taking, in such manner as not to lessen the volume of water in the said channel; (*b*) for the construction on or through Dominion or other lands of sluices, races, dams or other works necessary in connection with such diversion, taking or use of water; (*c*) for the transmission, distribution, sale and use of power and energy generated therefrom; (*d*) for the damming of and diversion of any stream, watercourse, lake or other body of water for the purpose of storing water to augment or increase the flow of water for power purposes during dry season; (*e*) for fixing the fees, charges, rents, royalties or dues to be paid for the use of water for power purposes, and the rates to be charged for power or energy derived therefrom.

3. Any person who under such regulations is authorized to divert, take or use water for power purposes, or to construct works in connection with the diversion, taking or use of water for such purposes, shall for the purposes of his undertaking have the powers conferred by the *Railway Act* upon railway companies, including those for the acquisition and taking of the requisite lands, so far as such powers are applicable to the undertaking and are not inconsistent with the provisions of this Act or the regulations thereunder, or with the authority given to such persons under such regulations—the provisions of the said *Railway Act* giving such powers being taken for the purposes of this section to refer to the undertaking of such person where in that Act they refer to the railway of the railway company concerned.

4. All maps, plans and books of reference showing lands other than Crown land necessary to be acquired by any such person for right of way or other purposes in connection with his undertaking shall be signed and certified correct by a duly qualified Dominion Land Surveyor.

5. Such maps, plans and books of reference shall be prepared in duplicate, and one copy thereof shall be filed in the office of the Minister at Ottawa, and the other shall be registered in the land titles office for the registration district within which the lands affected are situated.

6. The Minister, or such officer as he designates, shall in case of dispute, be the sole and final judge as to the area of land which may be taken by any person without the consent of the owner for any purpose in connection with any water-power undertaking.

Regulations Governing the Granting of Water-power Rights in the Provinces of Manitoba, Saskatchewan and Alberta, and the Northwest Territories.

(Established by Orders in Council dated June 2, 1909; June 8, 1909; April 20, 1910; and January 24, 1911.)

1. Under these regulations the word "works" shall be held to mean and include all sluices, races, dams, weirs, tunnels, pits, slides, flumes, machines fixed to the soil, buildings and other structures for taking, diverting and storing water for power purposes, or for developing water-power and rendering the same available for use.

Mode of Application.

2. Every applicant for a license to take and use water for power purposes shall file with the Minister of the Interior a statement in duplicate setting forth:—

(a) The name, address and occupation of the applicant.

(b) The financial standing of the applicant so far as it relates to his ability to carry out the proposed works.

(c) The character of the proposed works.

(d) The name, or if unnamed, a sufficient description of the river, lake or other source from which water is proposed to be taken or diverted.

(e) The point of diversion.

(f) The height of the fall or rapid of such river, lake or other source of water at high, medium and low stages, with corresponding discharges of water per second, reckoned approximately in cubic feet.

(g) A reasonably accurate description, and the area, of the lands required in connection with the proposed works, such lands, if in surveyed territory, to be described by section, township and range, or river or other lot, as the case may be, and a statement whether such lands are or are not Dominion lands.

(h) If such lands be not Dominion lands, then the applicant shall give the name of the registered owner in fee, and of any registered mortgagee or lessee thereof, and of any claimant in actual possession other than a registered owner, mortgagee or lessee.

(i) The minimum and maximum amount of water-power which the applicant proposes to develop, and the maximum amount of water which he desires for such purpose.

(j) Sketch plan showing approximate locations of the proposed works.

(k) Elevations of head water and tail water of the nearest existing works, if any, below and above the proposed works.

(l) Particulars as to any water to be taken, diverted or stored to the detriment of the operation of existing works, if any.

(m) Particulars as to any irrigation ditches or reservoirs, or other works for irrigation within the meaning of the *Irrigation Act*, in use or in course of construction within the vicinity of the proposed works, and which might affect or be affected by the operation of the proposed works.

Application by a Company.

3. If the applicant be an incorporated company, the statement shall, in addition to the foregoing information, set forth:—

(a) The name of the company.

(b) The names of the directors and officers of the company, and their places of residence.

(c) The head office of the company in Canada.

(d) The amount of subscribed and paid-up capital, and the proposed method of raising further funds, if required, for the construction and operation of the proposed works.

(e) Copy of such parts of the charter or memorandum of association as authorize the application and proposed works.

Application by a Municipality.

4. If the applicant be a municipality, then, excluding the special information to be given by a company, the following information shall be given:—

(a) The location, area and boundaries of the municipality.

(b) The approximate number of its inhabitants.

(c) The present estimated value of the property owned by such municipality and the value of the property subject to taxation by such municipality.

Minister may request Further Information.

5. The Minister of the Interior shall have the power to call for such other plans and descriptions, together with such measurements, specifications, levels, profiles, elevations and other information as he may deem neccessary, and the same shall be furnished by and at the expense of the applicant.

The Agreement for a License.

6. Upon receipt and consideration of the application, and information accompanying same, the Minister of the Interior may, if he approve of the proposed works, enter into an agreement with the applicant, which agreement, in addition to usual conditions and covenants, shall contain clauses to provide as follows:—

(a) For a time within which the proposed works shall be begun.

(b) For a stated minimum amount of expenditure to be made in connection with the works annually during the term of the agreement.

(c) For a stated amount of water-power to be developed from the water applied for within a fixed period not exceeding five years.

(d) For summary cancellation of the agreement by the Minister if any of the above conditions have not been complied with.

(e) For defining and allotting the areas of Dominion lands within which the applicant may construct and operate the proposed works; and if there be no Dominion lands available for such purpose then for defining and allotting the lands in regard to which the applicant may exercise the powers given under section 35, subsection 3 of the *Dominion Lands Act*.

(f) For granting a license to the applicant, upon fulfilment of the said agreement, to take, divert and use for power purposes a stated maximum amount of water, in accordance with the application, and plans and specifications as approved by the Minister; the term of such license to be twenty-one years at a fixed fee payable annually, and such license to be renewable as provided for in these regulations.

(g) For granting a lease to the applicant of such Dominion lands as may be allotted under paragraph *(e)* of this section, and approved of by the minister, such lease to be at a fixed rental for a term of twenty-one years running concurrently with the said license, and renewable in like manner, and as near as may be subject to all the terms and conditions thereof. When there are no Dominion lands available for such purpose, or when other lands are considered by the Minister to be more suitable for such purpose, then the Minister shall define such lands in regard to which the applicant may exercise the powers given under section 35, subsection 3, of the *Dominion Lands Act.*

7. During the construction of any works for the development of water-power the Minister of the Interior, or any engineer appointed by him for that purpose, shall have free access to all parts of such works for the purpose of inspecting same, and ascertaining if the construction thereof is in accordance with the plans and specifications approved of by the Minister, and whether the terms of the agreement, as provided for in the preceding section, are being fulfilled.

The License.

8. Upon fulfilment by the applicant of all conditions of the said agreement, the Minister of the Interior shall grant to the applicant a license as agreed upon; and such license shall contain clauses to provide as follows:—

(a) The term of the license shall be twenty-one years, renewable for three further consecutive terms of twenty-one years each, at a fixed fee payable annually and to be readjusted at the beginning of each term, as hereunder provided.

(b) At the expiry of each term of twenty-one years the Governor in Council, may, on the recommendation of the Minister, order and direct that the license and any lease granted in connection therewith be cancelled: Provided that the Minister shall have given at least one year's notice to the licensee of intention so to cancel.

(c) If the licensee shall refuse to pay the license fee as readjusted by the Governor in Council, or as fixed by arbitrators chosen as provided in paragraph *(e)* hereunder, then in such case the Minister may renew the license at the former fee, or the Governor in Council may, on the recommendation of the Minister, order and direct that the license and any lease issued in connection therewith be cancelled.

(d) In either of the above cases compensation shall be paid to the licensee as provided for in paragraph *(e)* hereunder.

(e) On termination of the third renewal of such license, except in case of default on the part of the licensee in observance of any of the conditions thereof, or of any lease granted in connection therewith, compensation shall be paid for the works to the amount fixed by arbitration, one arbitrator to be appointed by the Governor in Council, the second by the licensee, and the third by the two so appointed. If the licensee fails to appoint an arbitrator within ten days after being notified by the Minister to make such appointment, or if the two arbitrators appointed by the Governor General in Council and the licensee fail to agree upon a third arbitrator within ten days after their appointment or within such further period as may be fixed by the Minister in either such cases, such arbitrator or third arbitrator as the case may be, shall be appointed by the Judge of the Exchequer Court of Canada. In fixing the amount of compensation only the value of the actual and tangible works and of any lands held in fee in connection therewith shall be considered, and not the value of the rights and privileges granted, or the revenues, profits or dividends, being, or likely to be, derived there from.

(f) The license shall state the maximum amount of water which the licensee may divert, store and use for power purposes, and shall provide for the return to the stream, or other source of water, of the full amount so diverted.

(g) The licensee shall develop such power as, in the opinion of the Minister, there shall be a public demand for, up to the full extent possible from the amount of water granted by the license.

(h) Upon a report being made by the Minister of the Interior to the Governor in Council that the licensee has not developed the amount of power for which there is a public demand, and which could be developed from the amount of water granted by the license, the Governor in Council may order to be developed and rendered available for public use the additional amount of power for which there is, in the opinion of the Minister, a public demand, up to the full extent possible from the amount of water granted by the license, and within a period to be fixed by the Minister, which period shall not be less than two years after the licensee or person in charge of the existing works shall have been notified of such order, and in default of compliance with such order the Governor in Council may direct that the license, together with any lease issued under these regulations shall be cancelled, and the works shall thereupon vest and become the property of the Crown without any compensation to the licensee.

(i) Upon a report being made by the Minister of the Interior to the Governor in Council that a greater amount of water-power could be developed advantageously to the public interests from the same stream or other source of water from which the existing works derive power, and (1st) that the existing works could be enlarged or added to for such purpose, then the Governor in Council may authorize the Minister to offer the licensee the privilege of constructing and operating such enlarged or additional works at or in the vicinity of the existing works, and to grant such supplementary license as he may consider proper for such purpose, and if the licensee fail within six months thereafter to accept such offer, and in good faith to begin and carry on to completion such enlarged or additional works, and to complete same in accordance with plans and specifications approved of by the Minister, and within a fixed period not to exceed five years, and upon like conditions as the existing works were begun and completed; or (2nd) if the Minister shall report to the Governor in Council that the existing works, owing to their location or construction, cannot advantageously be enlarged or added to in order to develop further power sufficient to meet the probable demand, or would be a hindrance to other works contemplated for such purpose; or (3rd) that the existing works cannot, or will not, be any longer advantageously operated owing to the exercise of rights existing or created under *The Irrigation Act;* then in every such case, the Governor in Council may order and direct that the license, and any lease in connection therewith, and all rights thereunder, shall be cancelled, and the existing works shall thereupon vest in and become the property of the Crown: Provided always that in every such case compensation shall be paid to the licensee as provided for in paragraph *(e)* of section 8 of these regulations, together with a bonus apportioned as follows:—

(1) If the works have been in operation less than five years, a thirty per cent bonus upon the value of the works.

(2) If in operation more than five, and less than ten years, a twenty-five per cent bonus.

(3) If in operation more than ten, and less than fifteen years, a twenty per cent bonus.

(4) If in operation more than fifteen, and less than twenty years, a fifteen per cent bonus.

(5) If in operation twenty years or more, a ten per cent bonus.

(j) That the license shall not be transferable without the written consent of the Minister, and that if the licensee fail to keep and observe all or any of the conditions of the license, or any renewal thereof, or of any lease to be issued in connection therewith, then the license, together with such lease, shall in every

case be subject to cancellation by the Exchequer Court on the application of the Crown.

(k) That a schedule of rates and prices to be charged to the public for the use of power shall first be submitted by the licensee to the Board of Railway Commissioners of Canada for adjustment and approval before being put into effect, and that no rates or prices for power shall be legal or enforceable until such schedule has been so adjusted and approved nor if they shall exceed the amount fixed by such schedule; and that such schedule shall be readjusted and approved by the Board every seven years during the term of the lease and license, and all renewals thereof.

(l) That for the purpose of ascertaining the quantity of power actually developed, or capable of being developed, from the amount of water granted by such license, the Minister, or any engineer appointed by him for that purpose, shall have free access to all parts of the works, and to all books, plans or records in connection therewith, bearing on the quantity of power developed, and may make measurements, take observations and do such other things as he may consider necessary or expedient for such purpose, and the findings of the Minister, or such engineer thereon, shall be conclusive and binding upon the licensee.

(m) For the proper provision, as required by law, for the passage of logs and timber down the stream or other waterway affected by the works.

(n) For the erection and maintenance by the licensee of a durable and efficient fishway in the stream or other waterway affected by the works when so required by the proper officer or authority in that behalf.

(o) That the licensee shall have no right to any water beyond the amount stated in the license.

(p) For the indemnifying of the Crown against all actions, claims or demands against it by reason of anything done by the licensee in the exercise, or purported exercise, of the rights and privileges granted under the lease or license.

9. The agreements and licenses to be issued hereunder shall, subject always to the provisions of these regulations, be in such form and contain such provisions as the Minister may from time to time determine.

Storage of Water.

10. If at any time it is proposed by the applicant or the licensee to divert water from any lake or body of water for storage purposes, or to dam same in order to augment the flow of water in any stream from which water-power is to be developed, the applicant or licensee shall, in addition to other information required under these regulations, file plans as follows:—

(a) A general plan in duplicate, on tracing linen, showing the location of such lake or other body of water, and the lands to be submerged or otherwise affected, and contour lines showing the water level at high and low stages, and the level to which it is proposed to raise such water for storage, and the estimated storage capacity of such lake or other body of water.

(b) A plan in duplicate, from actual survey, by a Dominion Land Surveyor, and certified to by him, showing the lands to be submerged or otherwise affected by the proposed storage; the name of the registered owner in fee of such lands, and of any registered mortgagee or lessee thereof, and of any claimant in actual possession other than a registered owner, mortgagee or lessee.

(c) A detail plan in duplicate on tracing linen, showing all dams and other works proposed to be constructed in connection with such storage.

11. When the plans for such storage of water have been approved of by the Minister of the Interior, provision for same shall be made in the agreement for a license, or in the license itself, or in a supplementary license to be issued for such purpose, upon such terms and conditions as may appear to the Minister

reasonable or expedient in the circumstances of each case, and subject to these regulations.

Small Water-Powers of less capacity than 200 horse-power.

12. If, upon receipt and consideration of the information set out in sections 2, 3, 4 and 5, the water-power to be developed is found to have no greater capacity than 200 horse-power at the average low stage of water, the minister may issue a lease and a license as may be required, authorizing the development of the proposed power; the lease and license to be for a period of ten years, subject to such special terms and conditions as may be considered advisable in each particular case, and renewable if in the opinion of the minister the power has been continuously and beneficially used.

APPENDIX VII

RUN-OFF DATA.

RUN-OFF DATA.

NOTE.—The data contained in the following 96 pages were collected and published by the Irrigation Branch of the Department of the Interior under the title of Progress of Streams Measurements for the years 1909, 1910, 1911 and 1912.

DISCHARGE MEASUREMENTS of Bow River near Laggan in 1910.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
July 18	J. C. Keith	112·3	300·45	5·832	3·43	1752·30
Aug. 12	do	111·3	243·50	4·974	3·02	1202·24
Sept. 2	do	73·2	99·70	3·328	2·12	331·79
Sept. 24	do	97·8	127·22	3·142	2·285	399·75
Oct. 20	H. R. Carscallen	85·6	104·74	3·25	2·14	340·63
Nov. 8	do	42·0	66·43	2·68	1·66	178·02
Dec. 5	do	42·0	57·88	2·084	1·33	120·62
Dec. 29	do	42·0	50·33	1·814	1·26	91·31

DISCHARGE MEASUREMENTS of Bow River at Laggan, Alta., in 1911.

Date.	Hydrographer.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Jan 30	H. R. Carscallen	40·5	55·9	1·49	2·68	83·2x
Feb 13	do	35·5	45·1	1·10	1·94	49·4x
Mar. 6	do	35·5	36·8	1·48	1·30	51·1x
Mar. 23	do	42	45·2	1·41	1·02	63·7x
Apr. 7	H. C. Ritchie	43·5	53·4	1·52	1·04	81·1x
Apr. 27	do	43·5	58·8	1·88	1·25	110·7x
May 11	do	62·5	93·4	2·85	1·85	265·9x
June 1	B. Russell	103·8	184·6	3·50	2·47	647·6x
June 16	do	111·8	310·6	5·77	3·32	1793·0x
July 1	do	110·0	277·6	5·71	3·17	1585·0x
July 14	do	86·3	232·8	4·54	2·84	1058·0x
July 27	H. C. Ritchie	111·5	259·6	5·24	3·11	1360·0x
Aug. 18	H. Brown	108·3	200·0	3·99	2·59	798·7x
Sept. 5	do	69·5	157·9	4·90	6·38	774·2*
Sept. 21	do	61·5	98·3	3·13	5·48	336·7*
Oct. 17	V. A. Newhall	47·7	46·1	2·79	4·64	128·5*
Nov. 2	do	34·5	29·0	1·95	4·37	56·8*
Nov. 20	do	61·5	289·5	0·23	†	65·5*‡
Dec. 4	do	61	196·0	0·62	†	121·7***
Dec. 6	do	42	38·2	1·65	†	63·2**
Dec. 18	do	45	42·2	1·43	†	60·2*

xDischarge measured at old station. *Discharge measured at new station.
†Gauge not read owing to backwater caused by ice jam. ‡May be slightly inaccurate owing to slush ice.
*Accuracy affected by great amount of frozen slush ice causing cross-currents.
**Gauging made at an open water section west of Laggan. Probable error small.

Daily Gauge Height and Discharge of Bow River at Laggan, Alta., for 1911.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height	Dis. charge.	Gauge Height	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·65	114	2·65	80	1·85	53	1·10	90	1·33	125	2·42	617
2	1·90	130	2·65	80	1·80	53	1·08	87·6	1·35	129	2·66	850
3	2·80	210	2·75	90	1·40	46	1·05	84	1·53	167	2·82	1,035
4	2·90	216	2·70	85	1·38	48	1·05	84	1·60	185	2·80	1,010
5	3·00	216	2·65	80	1·30	48	1·05	84	1·75	230	2·63	818
6	2·85	195	2·65	80	1·25	48	1·05	84	1·85	266	2·64	828
7	2·35	140	2·40	65	1·15	48	1·10	90	1·80	247	2·65	839
8	2·35	135	2·20	57	1·10	48	1·20	103	1·78	240	2·60	786
9	2·50	140	2·10	53	1·03	47	1·30	120	1·80	247	2·60	786
10	2·50	130	2·00	49	1·03	48	1·40	139	1·80	247	2·70	894
11	2·60	130	2·00	49	1·03	49	1·45	149	1·85	266	2·76	963
12	2·60	121	1·98	48·2	1·03	51	1·15	96	1·85	266	3·05	1,349
13	2·40	95	1·96	47·4	1·00	51	1·10	90	1·85	266	3·12	1,456
14	2·20	72	1·95	47	0·95	50	1·05	84	1·76	233	3·27	1,697
15	2·20	66	1·95	47	0·95	52	1·05	84	1·89	283	3·35	1,832
16	2·10	59	1·98	48·2	0·95	53	1·03	81·6	2·07	371	3·32	1,781
17	2·05	51	2·00	49	0·95	54	1·05	84	2·25	484	3·33	1,798
18	2·05	51	2·05	51	0·95	55	1·05	84	2·20	450	3·34	1,815
19	2·05	51	2·05	51	0·95	56	1·05	84	2·25	484	3·30	1,747
20	2·05	51	2·10	53	0·95	57	1·03	81·6	2·25	484	3·16	1,519
21	2·10	53	2·00	49	0·95	58	1·08	87·6	2·30	520	3·12	1,456
22	2·00	49	2·03	50·2	0·95	59	1·08	87·6	2·28	506	3·45	2,008
23	2·10	53	2·05	51	1·00	62	1·12	92·4	2·16	424	3·40	1,919
24	2·10	53	2·05	51	1·02	66	1·15	96	2·09	382	3·48	2,063
25	†2·05	51	2·08	52·2	1·05	70	1·20	103	2·03	350	3·40	1,919
26	2·00	49	2·10	53	1·05	71	1·20	103	1·95	310	3·32	1,781
27	2·20	57	2·05	51	1·05	74	1·25	111	1·86	270	3·25	1,664
28	2·20	57	1·90	51	1·05	77	1·30	120	1·91	292	3·24	1,648
29	2·10	53	.....	.....	1·06	89	1·40	139	1·96	315	3·20	1,583
30	2·68	83	.....	.....	1·06	82	1·45	149	2·06	366	3·22	1,615
31	2·65	80	.....	.....	1·06	85	.....	.....	2·18	437	.....	.....

Note.—Gauge height observations were made at the old gauging station until the end of August. After that they were taken at the cable station. An ice jam a short distance below the station caused backwater on the gauge and made it impossible to compute daily discharges after November 9.

SESSIONAL PAPER No. 25e

Daily Gauge Height and Discharge of Bow River at Laggan, Alta., for 1911. —*Continued.*

Day.	July.		August.		September.		October.		November.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	3·19	1567	2·98	1248	6·56	870	4·95	169	4·31	50·2
2	3·18	1551	2·93	1178	6·65	919	4·92	162	4·47	71·2
3	3·17	1535	2·96	1219	6·67	930	4·90	157	4·53	81·4
4	3·09	1410	3·00	1276	6·55	865	4·87	150	4·53	81·4
5	3·06	1364	3·01	1291	6·38	773	4·85	145	4·55	85
6	3·05	1349	2·99	1262	6·25	703	4·82	138	4·56	86·9
7	3·03	1320	2·93	1178	6·08	613	4·79	132	4·53	81·4
8	3·00	1276	2·82	1035	5·99	568	4·76	125	4·37	57·4
9	2·92	1164	2·75	951	5·90	523	4·76	125	4·30	49·0
10	2·89	1124	2·68	872	5·90	523	4·75	123	.....	.....
11	2·85	1072	2·63	818	5·94	543	4·75	123	.....	.....
12	2·80	1010	2·65	839	6·01	578	4·75	123	.....	.....
13	2·81	1022	2·65	839	6·11	628	4·75	123	.....	.....
14	2·82	1035	2·63	818	6·05	598	4·75	123	.....	.....
15	2·82	1035	2·60	786	5·95	548	4·73	119	.....	.....
16	3·03	1320	2·58	766	5·80	475	4·66	105	—	.....
17	3·02	1305	2·62	807	5·70	430	4·66	105	.....	.....
18	3·02	1305	2·65	839	5·60	386	4·67	107	.....	.....
19	3·00	1276	2·65	839	5·50	345	4·64	101	.....	.....
20	2·96	1219	2·65	839	5·50	345	4·57	88·6	.....	.....
21	2·98	1248	2·63	818	5·48	337	4·70	113	.....	.....
22	3·02	1305	2·59	776	5·40	307	4·58	90·4	.....	.....
23	3·03	1320	2·57	756	5·32	279	4·54	83·2	.....	.....
24	3·10	1425	2·57	756	5·22	246	4·52	79·6	.....	.....
25	3·20	1583	2·58	766	5·18	234	4·53	81·4	.....	.....
26	3·19	1567	2·57	756	5·14	222	4·35	55	.....	.....
27	3·11	1441	2·47	661	5·08	204	4·33	52·6	.....	.....
28	3·09	1410	2·45	643	5·04	193	4·41	62·4	.....	.....
29	3·08	1395	2·50	688	5·00	182	4·28	46·6	.....	.....
30	3·05	1349	2·55	736	4·97	174	4·40	61	.....	.....
31	3·01	1291	2·55	736	.....	.....	4·42	63·8	.....	.....

Drainage area, 166 square miles.

Monthly Discharge of Bow River at Laggan, Alta., for 1911.

Month.	Discharge in Second-Feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	216	49	97·1	0·585	0·67	5,970
February	90	47	57·8	0·348	0·36	3,210
March	89	46	58·3	0·351	0·40	3,585
April	149	81·6	99·1	0·597	0·67	5,897
May	520	125	317	1·91	2·20	19,492
June	2,063	617	1,403	8·45	9·43	83,484
July	1,583	1,010	1,309	7·89	9·10	80,488
August	1,291	643	897	5·40	6·23	55,154
September	930	174	485	2·92	3·26	28,860
October	169	46·6	108	0·651	0·75	6,641
November (1-9)	86·8	19	71·5	0·431	0·14	1,276
The period	.....	.....	.....	.....	33·21	294,057

Discharge Measurements of Bow River at Laggan, in 1912.

Date.	Hydrographer.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Jan. 23	V. A. Newhall	10·00	15·35	2·18	.....	33·43
Feb. 5	do	11·00	14·90	1·78	4·76	26·55
Feb. 16	do	39·60	60·87	2·33	.....	141.73
Feb. 28	do	16·00	36·60	2·00	7·45	73·06
Mar. 8	H. C. Ritchie	15·00	28·80	1·66	5·30	48·60
Mar. 18	do	15·00	22·80	1·50	4·73	37·50
Mar. 28	do	14·00	22·60	1·95	4·78	40·50
April 9	do	40·00	31·00	1·28	4·38	39·66
April 24	do	45·00	44·00	1·63	4·64	71·93
May 9	do	51·00	75·90	2·36	5·41	178·90
May 22	do	65·00	118·75	3·05	6·05	362·17
June 5	do	59·00	79·80	2·70	5·45	215·46
June 19	do	72·00	216·35	5·25	7·59	1,136·12
July 4	do	71·00	196·95	5·01	7·07	985·13
July 18	do	71·00	176·40	4·79	6·88	844·29
Aug. 1	do	72·00	210·15	5·30	7·30	113·72
Aug. 13	do	70·00	190·15	4·66	6·87	885·16
Aug. 29	do	72·50	227·40	4·86	7·34	1,104·40
Sept. 12	do	65·00	125·70	3·21	6·08	404·00
Oct. 4	H. R. Cram	58·00	84·90	2·48	5·40	210·50
Oct. 17	H. C. Ritchie	52·50	83·50	2·54	5·30	212·70
Nov. 1	do	46·00	53·40	1·58	4·68	84·69
Nov. 14	do	46·50	66·50	1·76	4·95	117·20
Nov. 28	do	45·00	71·25	1·11	5·03	79·20

Daily Gauge Height and Discharge of Bow River at Laggan, for 1912.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	(1).....	5·54	46·76	6·46	59·64	4·75	35·70	4·65	71·00	5·81	313·35
2	.....	.....	5·37	44·38	6·43	59·22	4·72	35·28	4·62	67·40	5·74	292·35
3	.....	.....	5·34	43·96	6·25	56·70	4·68	34·72	4·73	81·70	5·61	255·95
4	.....	.....	5·14	41·16	6·22	56·28	4·66	34·44	4·75	84·50	5·55	240·25
5	.....	.....	4·76	35·84	5·98	52·92	4·72	35·28	4·85	100·00	5·45	215·75
6	.....	.....	4·94	38·36	5·80	50·41	4·68	(2) 34·72	4·86	101·65	5·45	215·75
7	.....	.....	4·86	37·24	5·53	46·62	4·60	65·00	5·17	156·65	5·60	253·25
8	.....	.....	4·84	36·96	5·43	45·22	4·50	54·50	5·26	174·55	6·14	427·25
9	.....	.....	4·84	36·96	5·24	42·56	4·38	42·40	5·41	206·55	6·59	665·75
10	.....	.....	4·84	36·96	4·96	38·64	4·40	44·00	5·31	184·85	6·65	702·25
11	.....	.....	4·86	37·24	5·11	40·74	4·44	47·20	5·26	174·55	6·76	770·20
12	.....	.....	4·86	37·24	4·94	38·36	4·44	47·20	5·35	193·25	6·98	906·60
13	.....	.....	4·94	38·36	4·94	38·36	4·44	47·20	5·52	232·75	7·50	1,229·00
14	.....	.....	5·33	43·82	4·92	38·08	4·45	48·00	5·85	325·75	7·16	1,018·20
15	.....	.....	9·56	101·00	4·92	38·08	4·46	48·90	6·25	475·75	7·51	1,235·20
16	.....	.....	9·95	107·00	4·90	37·80	4·50	54·50	6·45	582·25	7·20	1,043·00
17	.....	.....	9·99	107·50	4·75	35·70	4·55	59·50	6·25	475·75	7·29	1,098·80
18	.....	.....	9·95	107·00	4·74	35·56	4·57	61·70	6·24	471·15	7·41	1,173·20
19	.....	.....	9·50	100·50	4·86	37·24	4·59	63·90	6·09	407·55	7·59	1,284·80
20	.....	.....	8·72	90·00	5·02	39·48	4·58	62·80	6·05	392·75	7·71	1,359·20
21	.....	.....	8·55	87·00	5·05	39·90	4·51	55·50	5·85	325·75	7·86	1,452·20
22	.....	.....	8·76	91·00	4·92	38·08	4·58	62·80	6·06	396·45	7·87	1,458·40
23	.....	.....	8·47	86·00	4·78	36·12	4·61	66·20	5·96	361·65	8·10	1,601·00
24	(1)	.....	7·39	72·00	4·76	35·84	4·65	71·00	6·06	396·45	8·18	1,659·00
25	5·74	(2)49·56	7·60	74·00	4·78	36·12	4·71	78·90	6·20	452·75	8·20	1,663·00
26	5·74	49·56	6·40	58·80	4·80	36·40	4·64	69·80	6·45	582·25	8·39	1,780·80
27	5·73	49·42	6·35	58·10	4·88	37·52	4·65	71·00	6·65	702·25	8·51	1,855·20
28	5·73	49·42	7·42	72·10	4·80	36·40	4·63	68·60	6·50	611·25	8 15	1,632·00
29	5·73	49·42	6·26	56·84	4·78	36·12	4·64	69·80	6·28	490·45	7·70	1,353·00
30	5·73	49·42	.....	.....	4·78	36·12	4·74	83·10	6·14	427·25	7·60	1,291·00
31	5·64	48·16	.....	.....	4·73	35·42	.....	.....	5·96	361·65	.....	.....

(1) Ice jams rendered gauge heights useless Jan. 1 to 24. (2) Ice conditiond Jan. 25 to April 6.

Daily Gauge Height and Discharge of Bow River at Laggan, for 1912.—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height	Discharge.	Gauge Height	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	7·33	1123·6	7·27	1086·4	6·59	665·8	5·31	184·8	4·75	84·5	5·96	76·0
2	7·30	1105·0	7·35	1136·0	6·49	606·4	5·28	178·6	4·81	93·6	6·17	76·0
3	7·19	1036·8	7·35	1136·0	6·44	576·6	5·37	197·6	4·86	101·6	6·46	76·0
4	7·08	968·6	7·57	1272·4	6·30	500·2	5·37	197·6	4·89	106·6	6·60	75·0
5	7·08	968·6	7·65	1322·0	6·25	475·8	5·34	191·2	4·94	115·0	6·98	75·0
6	7·44	1191·8	7·31	1111·2	6·15	431·2	5·29	180·7	4·94	115·0	7·25	74·0
7	7·31	111·2	7·13	999·6	6·10	411·2	5·25	172·5	4·95	116·8	7·28	74·0
8	7·18	1030·6	7·10	981·0	6·09	407·6	5·25	172·5	4·98	121·5	7·16	74·0
9	7·15	1012·0	7·35	1136·0	6·00	375·2	5·18	158·6	4·98	121·5	6·99	74·0
10	7·16	1018·2	7·31	1111·2	5·98	368·4	5·16	154·7	5·12	147·0	6·74	75·0
11	7·20	1043·0	7·25	1074·0	5·98	368·4	5·14	150·8	5·01	126·8	6·64	76·0
12	7·15	1012·0	7·03	937·6	6·08	403·8	5·06	135·8	4·99	123·8	6·76	75·0
13	7·33	1123·6	6·85	826·0	6·09	407·8	5·06	135·8	4·96	118·5	6·65	76·0
14	7·00	919·0	6·78	782·6	6·02	382·2	5·06	135·8	4·95	116·8	6·35	76·0
15	6·95	888·0	6·84	819·8	5·94	354·9	5·04	132·2	4·74	83·1	6·27	76·0
16	6·88	844·6	7·24	1067·8	5·89	338·6	5·11	145·2	4·90	102·0	6·27	76·0
17	6·84	819·8	7·48	1216·6	5·87	332·2	5·28	178·6	4·96	107·0	6·27	76·0
18	6·86	832·2	7·26	1080·2	5·85	325·8	5·21	164·5	4·90	96·0	6·12	76·0
19	6·99	912·8	7·24	1067·8	5·78	304·2	5·16	154·7	4·75	78·0	6·09	76·0
20	7·06	956·2	7·24	1067·8	5·69	278·0	5·12	147·0	4·72	75·0	6·05	76·0
21	7·14	1005·8	7·30	1105·0	5·63	261·4	5·09	141·4	4·74	73·0	6·13	76·0
22	7·16	1018·2	7·48	1216·6	5·58	248·0	5·00	125·0	4·74	70·0	6·22	76·0
23	7·15	1012·0	7·65	1322·0	5·57	245·4	4·97	120·2	4·79	68·0	6·16	76·0
24	7·44	1191·8	8·44	1811·8	5·51	230·2	4·99	123·8	4·74	67·0	6·06	76·0
25	7·36	1142·2	8·56	1886·2	5·54	237·8	4·96	118·5	4·76	61·0	5·84	76·0
26	7·25	1074·0	8·09	1594·8	5·46	218·2	4·95	116·8	4·53	62·0	6·06	76·0
27	7·09	974·8	7·74	1377·8	5·44	213·4	4·95	116·8	4·76	68·0	6·00	76·0
28	6·94	881·8	7·56	1266·2	5·40	204·2	4·90	108·2	5·03	79·0	5·90	76·0
29	6·93	875·6	7·28	1092·6	5·30	182·8	4·76	86·0	5·33	78·0	5·80	76·0
30	7·04	943·8	6·97	900·4	5·31	184·8	4·69	76·2	5·59	77·0	5·90	76·0
31	7·19	1036·8	6·75	764·0	.....	.....	4·70	77·5	.....	.....	5·86	76·0

Monthly Discharge of Bow River at Laggan, for 1912.

(Drainage area, 166 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per Square Mile.	Depth in inches on Drainage Area.	Total in Acre-feet.
January	49·56	48·16	49·28	0·30	0·08	684
February	107·50	35·84	62·90	0·38	0·41	3,618
March	59·64	35·42	41·67	0·25	0·29	2,562
April	83·10	34·44	55·12	0·33	0·37	3,280
May	702·25	67·40	324·79	1·96	2·26	19,970
June	1,855·20	215·75	1,014·58	6·11	6·83	60,385
July	1,191·80	819·80	1,002·40	6·04	6·96	61,634
August	1,886·20	764·00	1,147·40	6·91	7·97	70,551
September	665·8	182·8	351·34	2·11	2·35	20,906
October	197·6	76·2	144·59	·87	1·00	8,885
November	147·0	61·0	95·10	·57	·63	5,659
December	76·0	74·0	88·12	·53	·61	5,418
The year					29·76	263,552

Discharge Measurements of Pipestone River, near Laggan, Alta., in 1911.

Date.	Hydrographer.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
		Feet.	Sq.-ft.	Ft. per sec.	Feet.	Sec.-ft.
Sept. 5	H. Brown	64·5	99·1	2·71	4·95	268·5
Sept. 21	do	58·5	74·9	2·13	4·54	159·8
Oct. 17	V. A. Newhall	52·2	50·2	1·74	4·24	87·2
Nov. 2	do	27·5	36·0	0·98	4·19	35·4
Dec. 19	do	14·2	31·3	1·38	.....	43·3

Daily Gauge Height and Discharge of Pipestone River, near Laggan, Alta, for 1911

Day.	September.		October.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	5·12	316	4·40	123
2	5·15	324	4·40	123
3	5·17	330	4·40	123
4	5·08	304	4·39	121
5	4·95	268	4·38	118
6	4·90	254	4·37	116
7	4·80	227	4·36	113
8	4·75	214	4·35	111
9	4·70	201	4·35	111
10	4·70	201	4·34	109
11	4·72	206	4·33	106
12	4·80	227	4·33	106
13	4·90	254	4·33	106
14	4·76	217	4·33	106
15	4·75	214	4·33	106
16	4·68	196	4·30	99
17	4·65	188	4·33	106
18	4·60	175	4·33	106
19	4·56	165	4·27	92·4
20	4·55	162	4·15	69
21	4·55	162	4·10	60
22	4·52	154	4·10	60
23	4·52	154	4·26	90·2
24	4·40	123	4·15	69
25	4·40	123	4·00	46
26	4·45	136	3·98	43·6
27	4·47	128	4·05	52
28	4·42	128	4·00	46
29	4·42	128	3·98	43·6
30	4·41	126	4·10	60
31	.....	.....	3·98	43·6

Note.—An ice jam formed below the station during the cold spell in the early part of November and caused the banks of the stream to overflow. Gauge height observations could not be applied and were therefore discontinued.

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Monthly Discharge of Pipestone River near Laggan, Alta., for 1911.

(Drainage area, 122 square miles.)

Month.	Discharge in Second-Feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total acre-feet.
September	330	123	200	1·639	1·83	11,901
October	123	43·6	89·8	0·739	0·85	5,522
The period					2·68	17,423

Discharge Measurements of Pipestone River, near Laggan, in 1912.

Date.	Hydrographer.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Jan. 23	V. A. Newhall	17·0	13·0	2·42	4·67	31·43
Feb. 5	do	24·0	28·6	1·17	4·25	33·37
Feb. 15	do	35·0	32·5	0·75	4·975	24·5
Feb. 28	do	35·0	26·5	0·68	4·40	17·91
Mar. 8	H. C. Ritchie	33·0	17·1	1·00	4·20	17·06
Mar. 19	do	33·0	9·8	1·26	4·16	12·41
Mar. 29	do	33·0	25·7	1·03	4·00	26·52
April 10	do	35·0	26·6	0·846	3·85	22·02
April 24	do	40·0	36·1	1·01	4·12	36·59
May 10	do	59·0	70·3	2·34	4·69	164·76
May 22	do	73·0	98·9	3·21	5·20	317·67
June 5	do	59·0	65·1	2·33	4·65	151·5
June 19	do	75·0	152·5	5·12	5·85	780·21
July 4	do	71·0	106·9	3·65	5·29	389·65
July 18	do	73·0	107·30	3·71	5·29	398·07
Aug. 1	do	74·0	120·30	3·93	5·42	472·81
Aug. 13	do	68·0	94·25	3·36	5·12	316·34
Aug. 29	do	74·0	126·80	4·21	5·50	533·30
Sept. 12	do	65·0	91·00	3·14	5·08	286·00
Oct. 4	H. R. Cram	60·5	68·20	2·38	4·68	182·00
Oct. 17	H. C. Ritchie	58·5	66·80	2·43	4·57	162·10
Nov 1	do	53·5	47·50	1·24	4·26	58·90
Nov. 14	do	58·0	58·10	1·32	4·60	76·50
Nov. 28	do			Ice jammed.		
Dec. 14	do	52·0	52·05	0·89	5·47	46·52

Daily Gauge Height and Discharge of Pipestone River, near Laggan, for 1912.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	(1.)	4·17	34·6	4·11	13·2	3·95	11·0	4·06	32·0	4·75	180·0
2	.....	.....	4·20	34·0	4·16	14·0	3·92	10·4	4·04	30·2	4·80	196·0
3	.....	.....	4·17	34·6	4·15	14·0	3·88	10·0	4·12	38·4	4·70	165·0
4	.....	.....	4·17	34·6	4·17	14·0	3·85	10·0	4·06	32·0	4·70	165·0
5	.....	.....	4·20	34·0	4·17	14·0	3·84	19·8	4·09	35·0	4·60	136·0
6	.....	.....	4·18	34·4	4·15	14·0	3·76	18·2	4·14	40·8	4·66	153·0
7	.....	.....	4·15	35·0	4·17	14·0	3·88	20·6	3·41	89·2	4·98	260·0
8	.....	.....	4·12	35·0	4·20	14·0	3·86	20·2	4·65	150·0	5·36	441·0
9	.....	.....	4·15	35·0	4·20	14·0	3·85	20·0	4·80	196·0	5·51	535·0
10	.....	.....	4·10	35·0	4·23	14·6	3·87	20·4	4·69	162·0	5·47	509·0
11	.....	.....	4·15	35·0	4·25	15·0	3·92	22·2	4·65	150·0	5·50	528·0
12	.....	.....	4·20	34·0	4·22	14·4	3·90	21·0	4·85	212·0	5·58	583·0
13	.....	.....	4·20	34·0	4·20	14·0	3·95	24·0	4·99	264·0	5·54	555·0
14	.....	.....	4·22	33·6	4·20	14·0	3·86	20·2	5·26	385·0	5·50	528·0
15	.....	.....	4·98	24·6	4·20	14·0	3·91	21·6	5·53	548·0	5·86	788·0
16	.....	.....	4·98	24·6	4·20	14·0	3·90	21·0	5·53	548·0	5·67	646·0
17	.....	.....	4·80	22·0	4·17	14·0	3·85	20·0	5·36	441·0	5·70	668·0
18	.....	.....	4·60	20·0	4·15	14·0	3·95	24·0	5·18	334·0	5·71	675·0
19	.....	.....	4·70	21·0	4·15	14·0	3·96	24·6	5·14	326·0	5·79	735·0
20	.....	.....	4·38	16·6	4·14	13·8	3·95	24·0	5·10	308·0	5·79	735·0
21	.....	.....	4·60	20·0	4·15	14·0	3·95	24·0	5·00	268·0	5·85	780·0
22	.....	.....	4·80	22·0	3·65	7·0	4·05	31·0	5·20	354·0	5·78	727·0
23	.....	.....	4·60	20·0	4·15	14·0	4·03	29·4	5·04	284·0	5·95	869·0
24	4·63	28·4	4·55	19·0	3·92	10·4	4·06	32·0	5·15	330·0	5·91	828·0
25	4·54	30·0	4·28	15·6	4·44	17·8	4·06	32·0	5·24	374·0	5·86	788·0
26	4·60	29·0	4·15	14·0	4·45	18·0	4·04	30·2	5·43	484·0	6·00	900·0
27	4·48	30·4	4·10	13·0	4·46	18·0	4·04	30·2	5·54	555·0	6·10	980·0
28	4·38	31·4	4·20	14·0	4·46	18·0	4·05	31·0	5·34	429·0	5·75	705·0
29	4·33	32·0	4·08	12·6	4·00	12·0	4·03	29·4	5·09	304·0	5·46	502·0
30	4·27	32·6	.....	.....	3·97	11·4	4·12	38·4	5·00	268·0	5·42	477·0
31	4·17	34·6	.....	.....	3·92	10·4	.....	.....	4·88	223·0	.....	.....

(1) No records Jan. 1 to 23.

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Daily Gauge Height and Discharge of Pipestone River near Laggan for 1912.—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge.	Gauge Height	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	5·30	407	5·38	453	5·22	364	4·64	147	4·26	59	6·14	410
2	5·35	435	5·42	471	5·14	326	4·60	136	4·31	64	6·11	380
3	5·31	413	5·37	447	5·13	321	4·55	123	4·46	92	6·01	310
4	5·25	379	5·50	528	5·09	304	4·55	123	4·55	108	5·91	262
5	5·30	407	5·57	576	5·14	326	4·61	139	4·58	110	5·80	210
6	5·71	675	5·35	435	5·04	284	4·60	136	4·56	102	5·85	212
7	5·59	590	5·23	369	5·00	268	4·57	128	4·56	98	5·84	197
8	5·56	569	5·23	369	5·02	276	4·58	131	4·58	98	5·68	140
9	5·54	555	5·36	441	4·96	252	4·55	123	4·58	94	5·60	108
10	5·54	555	5·30	407	4·94	244	4·55	123	4·66	106	5·53	88
11	5·52	542	5·26	385	4·97	256	4·50	110	4·66	102	5·35	48
12	5·46	502	5·13	321	5·04	284	4·41	89	4·65	98	5·46	58
13	5·58	583	5·06	292	5·01	272	4·48	105	4·61	82	5·55	66
14	5·40	465	5·05	288	5·01	272	4·48	105	4·58	76	5·45	46
15	5·34	429	5·07	296	4·87	219	4·48	105	4·35	32	5·30	36
16	5·32	418	5·39	459	4·84	209	4·52	115	5·21	227	5·30	36
17	5·25	379	5·59	590	4·83	206	4·57	128	4·72	80	5·30	36
18	5·25	379	5·48	515	4·83	206	4·54	120	4·85	100	5·14	28
19	5·27	390	5·54	555	4·78	190	4·50	110	4·68	58	5·12	28
20	5·34	429	5·58	583	4·71	168	4·48	105	4·63	46	5·04	25
21	5·31	413	5·61	604	4·64	147	4·41	89	4·66	44	4·98	24
22	5·35	435	5·59	590	4·72	171	4·40	87	4·65	40	5·05	26
23	5·35	435	5·64	625	4·71	168	4·38	83	4·74	46	5·05	26
24	5·65	632	6·17	1,036	4·63	144	4·44	96	4·75	44	5·00	24
25	5·51	535	6·15	1,020	4·69	162	4·41	89	5·33	168	4·89	23
26	5·45	496	5·77	720	4·64	147	4·41	89	5·72	292	4·95	24
27	5·36	441	5·60	597	4·64	147	4·20	49	6·05	440	4·91	23
28	5·28	396	5·53	548	4·61	139	4·14	41	6·21	520	4·87	23
29	5·28	396	5·45	496	4·59	133	4·10	36	6·17	478	4·86	22
30	5·30	407	5·34	429	4·59	133	4·06	32	6·15	440	4·89	23
31	5·33	424	5·26	385			4·06	32			4·86	22

Notes:—Changing conditions, Nov. 1 to Dec. 14.
Ice conditions, Dec. 15 to 31.

Monthly Discharge of Pipestone River near Laggan, for 1912.

(Drainage area, 122 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per Square Mile.	Depth in inches on Drainage Area.	Total in Acre-feet.
January (24-31)	34·6	28·4	31·0	0·25	0·07	493
February	35·0	12·6	26·3	0·22	0·24	1,513
March	18·0	7·0	13·9	0·11	0·13	855
April	38·4	10·0	23·0	0·19	0·21	1,369
May	555·0	30·2	264·7	2·17	2·50	16,276
June	980·0	136·0	557·6	4·57	5·10	33,179
July	675·0	379·0	468·1	3·84	4·43	28,782
August	1,036·0	288·0	510·7	4·18	4·82	31,401
September	364·0	133·0	224·6	1·84	2·05	13,364
October	147·0	32·0	100·8	0·83	0·96	6,198
November	520·0	32·0	145·0	1·19	1·33	8,628
December	410·0	22·0	96·2	0·788	0·91	5,915
The period					22·75	147,978

Discharge Measurements of Fortymile Creek, near Banff, in 1912.

Date.	Hydrographer.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
July 31	H. C. Ritchie	32	74·2	1·36	3·90	100·95
Aug. 19	do	32	96·7	1·95	4·55	188·6
Aug. 31	do	32	85·1	1·86	4·30	158·0
Sept. 14	do	32·5	76·4	1·61	3·89	123·0
Oct. 1	H. R. Cram	28·5	57·0	1·39	3·43	78·9
Oct. 15	do	28	53·5	1·28	3·25	68·2
Sept. 30	H. C. Ritchie	26	41·7	0·97	2·92	40·5
Nov. 12	do	27·5	46·0	1·20	3·04	55·2
Nov. 26	do	28·5	48·1	0·34	2·59	16·5
Dec. 10	do	28·5	53·8	0·42	3·30	22·8
Dec. 28	do	25·5	44·8	0·93	2·85	42·6

Daily Gauge Height and Discharge of Fortymile Creek, near Banff, for 1912.

Day.	August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	3·93	120	4·20	147	3·43	80	3·12	59	2·75	17·50
2	3·95	122	4·17	144	3·42	79	3·12	59	2·97	21·0
3	3·90	116	4·12	138	3·40	78	3·10	58	3·10	24·0
4	3·90	116	4·05	132	3·43	80	3·08	57	3·05	21·0
5	3·90	116	4·00	126	3·40	78	3·08	57	3·02	19·5
6	3·85	112	3·97	124	3·37	76	3·06	56	2·96	18·0
7	3·83	110	3·95	122	3·35	74	3·06	56	2·93	16·5
8	3·80	108	3·95	122	3·35	74	3·06	56	2·90	15·0
9	3·70	100	3·93	120	3·35	74	3·06	56	2·90	15·5
10	3·70	100	3·95	122	3·34	74	3·04	55	2·94	15·0
11	3·70	100	3·95	122	3·32	72	3·04	55	3·04	17·5
12	3·65	96	3·93	120	3·30	71	3·04	55	2·60	12·0
13	3·63	94	3·90	116	3·29	70	3·04*	53	2·65	13·0
14	3·60	92	3·85	112	3·27	69	3·10	56	2·78	16·0
15	3·60	92	3·83	110	3·24	67	3·15	59	2·85	19·0
16	3·75	104	3·77	106	3·24	67	3·15	58	2·70	17·50
17	4·35	164	3·72	101	3·26	68	3·13	55	2·70	18·0
18	4·50	182	3·70	100	3·24	67	3·12	53	2·72	20·0
19	4·50	182	3·70	100	3·25	68	3·10	50	2·75	22·0
20	4·60	194	3·68	98	3·23	66	3·06	46	2·74	23·0
21	4·57	190	3·65	96	3·20	64	3·04	43	3·45	59·0
22	4·50	182	3·62	94	3·18	63	3·00	39	2·73	26·0
23	4·37	166	3·58	91	3·18	63	2·98	36	2·95	37·0
24	4·52	184	3·55	88	3·16	62	2·98	34	2·90	37·0
25	5·10	254	3·54	87	3·16	62	2·70	31	2·87	38·0
26	4·82	220	3·50	85	3·16	62	2·59	16	2·85	40·0
27	4·57	190	3·48	83	3·15	61	2·59	16	2·83	41·0
28	4·50	182	3·44	80	3·15	61	2·58	15	2·85	44·0
29	4·45	176	3·44	80	3·14	60	2·70	17	2·85	44·0
30	4·37	166	3·43	80	3·14	60	2·75	17·50	2·83	43·0
31	4·27	155	.....	.....	3·14	60	.....	.....	2·83	43·0

*Shifting conditions Nov. 12 to Dec. 28, due to ice.

SESSIONAL PAPER No. 25e

Monthly Discharge of Fortymile Creek, near Banff, for 1912.

(Drainage area, 58 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per Square Mile.	Depth in inches on Drainage Area.	Total in Acre-feet.
August	254	92	145	2·50	2·88	8,916
September	147	80	108	1·86	2·08	6,426
October	80	60	69	1·19	1·37	4,243
November	59	15	45	·786	·874	2,678
December	59	12	26	·448	·516	1,599
The period					7·720	23,862

Note.—Gauge readings started Aug. 1, 1912.

Discharge Measurement of Bow River at Banff, Alta., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity	Gauge height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
June 9	P. M. Sauder	316·5	1,228	3·05	2·69	3,737
June 23	J. C. Keith	319·5	1,513	4·09	3·55	6,184
July 8	do	320·5	1,931	5·48	4·86	10,586
July 22	do	312·5	1,260	3·20	2·875	4,033
August 9	do	298·0	1,045	2·27	2·38	2,379
September 3	do	294·0	994	2·12	2·20	2,104
September 23	do	257·0	774	1·43	1·50	1,122

Daily Gauge Height and Discharge of Bow River at Banff, for 1909.

Day.	May.		June.		July.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	2·80	4,015	3·50	6,020
2	.....	.....	3·70	6,680	3·50	6,020
3	.....	.....	4·10	8,020	3·60	6,350
4	.....	.....	3·70	6,680	3·70	6,680
5	.....	.....	3·40	5,715	3·90	7,345
6	.....	.....	3·00	4,560	4·20	8,360
7	.....	.....	2·80	4,015	5·00	11,060
8	.....	.....	2·60	3,510	5·00	11,060
9	.....	.....	2·70	3,760	4·50	9,380
10	.....	.....	3·00	4,560	4·10	8,020
11	.....	.....	3·50	6,020	4·00	7,680
12	.....	.....	3·80	7,010	3·70	6,680
13	.....	.....	4·00	7,680	3·50	6,020
14	.....	.....	4·00	7,680	3·30	5,415
15	.....	.....	4·00	7,680	3·20	5,120
16	.....	.....	4·00	7,680	3·20	5,120
17	.....	.....	4·40	9,040	3·20	5,120
18	.....	.....	4·30	8,700	3·10	4,830
19	.....	.....	4·30	8,700	2·95	4,390
20	.....	.....	4·10	8,020	2·85	4,090
21	.....	.....	4·10	8,020	2·80	3,920
22	.....	.....	3·90	7,345	2,90	4,090
23	.....	.....	3·50	6,020	3·00	4,200
24	.....	.....	3·30	5,415	3·10	4,330
25	1·60	1,400	3·10	4,840	3·00	4,100
26	1·80	1,770	3·10	4,840	3·00	4,060
27	2·00	2,170	3·10	4,840	3·10	4,190
28	2·30	2,800	3·20	5,125	3·10	4,130
29	2·60	3,510	3·10	4,840	3·00	3,920
30	2·50	3,260	3·20	5,125	3·00	3,880
31	2·50	3,260	.....	.....	3·00	3,820

Daily Gauge Height and Discharge of Bow River at Banff, for 1909. —*Concluded.*

Day.	August.		September.		October.		November.	
	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	3·00	3,780	2·10	1,955	1·75	1,460	0·90	475
2	2·90	3,560	2·10	1,955	1·60	1,250	0·90	475
3	2·80	3,350	2·20	2,100	1·60	1,250	0·95	525
4	2·70	3,140	2·20	2,100	1·50	1,120	0·95	525
5	2·70	3,080	2·10	1,955	1·50	1,120	0·90	475
6	2·55	2,800	2·10	1,955	1·40	1,000	0·90	475
7	2·40	2,500	2·10	1,955	1·50	1,120	0·80	375
8	2·40	2,450	2·20	2,100	1·40	1,000	0·80	375
9	2·40	2,400	2·10	1,955	1·30	890	0·90	475
10	2·30	2,250	2·10	1,955	1·40	1,000	0·90	475
11	2·40	2,400	2·10	1,955	1·40	1,000	0·90	475
12	2·40	2,400	2·00	1,810	1·30	890	...	...
13	2·40	2,400	1·90	1,670	1·30	890	...	...
14	2·40	2,400	1·90	1,670	1·30	890	...	...
15	2·40	2,400	1·80	1,530	1·20	785	...	...
16	2·40	2,400	1·80	1,530	1·20	785	...	...
17	2·40	2,400	1·80	1,530	1·20	785	...	...
18	2·30	2,250	1·90	1,670	1·10	680	...	...
19	2·40	2,400	1·80	1,530	1·10	680	...	...
20	2·40	2,400	1·70	1,390	1·10	680	...	...
21	2·40	2,400	1·60	1,250	1·10	680	...	...
22	2·30	2,250	1·60	1,250	1·10	680	...	...
23	2·20	2,100	1·50	1,120	1·10	680	...	...
24	2·10	1,955	1·40	1,000	1·10	680	...	...
25	2·10	1,955	1·40	1,000	1·00	575	...	...
26	2·30	2,250	1·40	1,000	1·00	575	...	...
27	2·50	2,560	1·40	1,000	1·00	575	...	...
28	2·25	2,175	1·40	1,000	0·95	525	...	...
29	2·10	1,955	1·40	1,000	0·95	525	...	...
30	2·10	1,955	1·75	1,460	1·00	575	...	...
31	2·10	1,955	...	...	0·95	525	...	...

Note.—On September 23rd the gauge was lowered 1 foot and all previous observations were increased 1 foot to apply to the present position of the gauge.

Monthly Drainage of Bow River at Banff, Alta., for 1909.

(Drainage area, 876 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
May (25-31)	3,510	1,400	2,595·7	2·963	0·771	36,039
June	9,040	3,510	6,204·5	7·082	7·901	369,193
July	11,060	3,920	5,787·1	6·606	7·616	355,833
August	3,780	1,955	2,473·2	2·823	3·255	152,068
September	2,100	1,000	1,578·3	1·801	2·009	93,918
October	1,160	525	834·5	0·952	1·097	51,311
November (1-11)	525	375	465·9	0·532	0·218	10,165
The period	...	...	...	...	...	1,068,527

Discharge Measurements of Bow River at Banff, in 1910.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge Height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 13	C. Keith	304	1107·59	2·553	2·375	2827·20
June 3	do	317	1255·45	2·99	2·865	3745·43
June 17	do	322	1595·86	4·205	3·94	6710·95
July 15	do	320	1528·68	3·927	3·72	6003·60
Aug 11	do	315	1265·85	2·94	2·925	3727·37
Aug. 31	do	274	864·19	1·62	1·83	1403·57
Sept. 22	do	278	867·97	1·58	1·81	1378·02
Oct. 19	H. R. Cascallen	283	884·98	1·61	1·90	1428·02
Nov. 5	do	239·5	729·80	1·16	1·22	844·26
Dec. 1	do	119	517·85	0·86	*0·82	496·63
Dec 13	do	59	182·80	2·23	*0·52	406·85

*Ice conditions.

Daily Gauge Height and Discharge of Bow River at Banff, for 1910.

Day.	April.		May.		June.		July.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			1·75	1,978	2·85	3,708	3·45	5,190
2			1·65	1,865	3·05	4,165	3·4	5,045
3			1·65	1,865	2·9	3,815	3·3	4,760
4			1·7	1,920	2·7	3,400	3·3	4,760
5			1·8	2,035	2·7	3,400	3·3	4,760
6			2·15	2,490	2·9	3,815	3·25	4,620
7			2·4	2,865	3·25	4,657	3·25	4,620
8			2·6	3,210	3·2	4,530	3·35	4,902
9			2·7	3,400	3·1	4,285	3·3	4,760
10	·3	460	2·65	3,305	3·1	4,285	3·3	4,760
11	·3	460	2·45	2,947	3·7	5,980	3·3	4,760
12	·35	470	2·35	2,788	4·35	8,120	3·4	5,045
13	·5	518	2·35	2,787	4·05	7,100	3·5	5,335
14	·4	485	2·3	2,710	3·65	5,782	3·65	5,783
15	·35	470	2·2	2,560	3·6	5,630	3·7	5,935
16	·4	485	2·1	2,420	3·8	6,250	3·75	6,092
17	·4	485	2·1	2,420	3·9	6,575	3·8	6,250
18	·4	485	2·25	2,635	4·1	7,265	3·8	6,250
19	·5	518	2·25	2,635	3·7	5,935	3·65	5,783
20	·75	610	2·2	2,560	3·85	6,413	3·5	5,335
21	·8	630	2·2	2,560	4·05	7,088	3·45	5,190
22	·8	630	2·3	2,710	3·65	5,782	3·35	4,902
23	·85	650	2·7	3,400	3·35	4,903	3·25	4,620
24	1·15	810	3·0	4,045	3·2	4,480	3·15	4,343
25	1·55	1,092	3·35	4,915	3·1	4,205	2·95	3,792
26	1·9	2,155	3·7	5,940	3·4	5,045	2·9	3,655
27	2·1	2,420	3·55	5,475	3·7	5,935	2·75	3,243
28	2·1	2,420	3·2	4,530	3·8	6,250	2·7	3,105
29	1·95	2,220	2·95	3,930	3·75	6,092	2·6	2,855
30	1·85	2,095	2·75	3,500	3·55	5,483	2·6	2,855
31			2·7	3,400			2·7	3,105

From April 10 to 25, curve not sufficiently defined to read discharge.

Daily Gauge Height and Discharge of Bow River at Banff, for 1910.—*Continued.*

Day.	August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet. *	Sec.-ft.
1	2·7	3,105	1·8	1,370	1·5	1,055	1·3	905	0·82	496
2	2·65	2,980	1·8	1,370	1·5	1,055	1·3	905	.....	.....
3	2·55	2,732	1·8	1,370	1·5	1,055	1·3	905	.....	.....
4	2·6	2,855	1·9	1,500	1·45	1,015	1·25	872	0·75	475
5	2·75	3,243	1·85	1,435	1·4	975	1·2	840	.....	.....
6	3·1	4,205	1·95	1,573	1·4	975	1·2	840	0·79	487
7	3·1	4,205	1·85	1,435	1·6	1,150	1·2	840	0·77	481
8	2·95	3,792	1·8	1,370	1·55	1,102	1·2	840	0·8	490
9	3·0	3,930	1·7	1,255	1·6	1,150	1·2	840	0·79	487
10	3·0	3,930	1·7	1,255	1·9	1,500	1·2	840	0·68	454
11	2·95	3,793	1·6	1,150	1·9	1,500	1·2	840	0·6	430
12	2·9	3,655	1·6	1,150	1·85	1,435	1·1	780	0·73	469
13	2·85	3,517	1·6	1,150	1·8	1,370	1·15	810	0·75	475
14	2·8	3,380	1·5	1,055	1·75	1,313	0·8	630	0·70	460
15	2·75	3,243	1·5	1,055	1·75	1,312	1·05	753	0·64	442
16	2·6	2,855	1·5	1,055	1·8	1,370	0·9	675	0·67	451
17	2·55	2,732	1·5	1,055	1·85	1,435	†		0·71	463
18	2·45	2,498	1·55	1,102	1·9	1,500	.....	.....	0·66	448
19	2·4	2,385	1·6	1,150	1·85	1,435	.....	.....	0·64	442
20	2·5	2,610	1·65	1,203	1·8	1,370	.....	.....	0·67	430
21	2·45	2,497	1·75	1,312	1·8	1,370	.....	.....	0·66	448
22	2·4	2,385	1·8	1,370	1·7	1,255	.....	.....	0·50	404
23	2·35	2,283	1·8	1,370	1·7	1,255	.....	.....	0·57	424
24	2·25	2,085	1·85	1,435	1·6	1,150	.....	.....	0·68	454
25	2·15	1,900	1·75	1,313	1·6	1,150	.....	.....	0·65	445
26	2·05	1,727	1·7	1,255	1·55	1,103	.....	.....	0·65	445
27	2·0	1,645	1·6	1,150	1·35	940	.....	.....	0·64	442
28	2·0	1,645	1·6	1,150	1·45	1,015	.....	.....	0·60	430
29	1·9	1,500	1·6	1,150	1·45	1,015	.....	.....	0·59	427
30	1·85	1,435	1·6	1,150	1·45	1,015	.....	.....	0·63	439
31	1·8	1,370	.....	.....	1·4	975	.....	.....	0·44	392

*Ice conditions during all the month of December. †No gauge height observations from Nov. 17 to Dec. 1.

Monthly Discharge of Bow River at Banff, for 1910.

(Drainage area, 815 square miles).

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet
April 26-30	2,420	2,095	2,262	2·68	·498	22,433
May	5,940	1,865	3,690	3·66	4·22	193,018
June	8,120	3,490	5,345·8	6·32	7·05	318,098
July	6,250	2,855	4,722·9	5·59	6·445	290,400
August	4,205	1,370	2,778	3·29	3·79	170,816
September	1,573	1,055	1,257	1·49	1·66	74,806
October	1,500	940	1,203·7	1·42	·637	74,010
November 1-16	905	630	819	·97	·577	26,014
December, 28 days	496	392	451	·53	·55	25,047
The period	.....	.....	.....	.....	.....	1,391,642

Discharge Measurements of Bow River a Banff, Alta., in 1911.

Date.	Hydrographer.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Jan. 23	H. R. Carscallen	50	151·6	2·58	0·84	390·6x
Feb. 15	do	51	140·6	2·17	0·71	305·5x
Mar. 8	do	52	151·4	2·26	0·06	341·4x
Mar. 24	do	82·5	172·5	1·97	0·16	340·2†
Apr. 6	H. C. Ritchie	58	148·8	1·89	*0·04	281·3†
Apr. 26	do	161·5	586·9	1·01	0·65	592·7
May 10	do	240	739·6	1·51	1·24	1,114
May 31	B. Russell	284·5	957·5	1·93	1·90	1,852
June 15	do	320	1709	4·62	4·35	7,908
June 29	do	322	1566	4·03	3·90	6,309
July 13	do	320	1305	3·01	2·98	3,928
July 26	H. C. Ritchie	319	1376	3·25	3·30	4,465
Aug. 17	H. Brown	305	1092	2·25	2·49	2,456
Aug. 31	do	297	1042	1·98	2·26	2·066
Sept. 18	do	279	872·1	1·56	1·73	1,365
Oct. 18	V. A. Newhall	199·5	655·8	1·03	1·09	373·8
Nov. 4	do	130·5	556·3	0·99	0·85	553·0
Nov. 24	do	114	473·7	1·00	0 76	474·0†
Dec. 21	do	54·5	173·0	1·89	0·41	327·4†

* Negative gauge height. x Ice conditions. † Partly frozen over.

Daily Gauge Heights and Discharge of Bow River at Banff, Alta., for 1911.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	0·25	280	0·76	336	0·40	240	0·06	313	0·76	669	2·35	2,595
2	0·23	260	0·81	367	0·44	270	†*0·01	292	0·90	795	3·10	4,210
3	0·44	345	0·88	416	0·41	285	*0·08	274	0·94	831	3·50	5,200
4	0·47	345	0·92	444	0·20	255	*0·11	268	1·04	921	3·50	5,200
5	0·54	375	1·04	537	†0·16	265	*0·04	283	1·23	1,100	3·15	4,330
6	0·58	375	0·92	444	0·11	280	0·04	307	1·42	1,290	3·00	3,970
7	0·59	375	0·91	437	0·10	300	*0·01	292	1·38	1,250	2·90	3,735
8	0·55	320	0·89	423	0·04	307	*0·02	289	1·31	1,180	2·90	3,735
9	0·29	210	0·91	437	0·04	307	†0·00	295	1·27	1,140	2·90	3,735
10	0·41	240	0·91	437	0·02	391	0·01	298	1·23	1,100	2·95	3,850
11	0·48	265	0·89	423	*0·02	289	*0·01	292	1·22	1,090	3·35	4,815
12	0·60	300	0·87	409	†*0·02	289	*0·05	280	1·21	1,080	3·98	6,572
13	0·59	280	0·73	318	*0·03	286	*0·05	280	1·20	1,070	4·35	7,900
14	0·65	295	0·71	306	0·03	304	*0·04	283	1·20	1,070	4·70	9,310
15	0·70	300	0·67	285	*0·02	289	*0·04	283	1·25	1,120	4·40	8,095
16	0·72	312	0·71	306	*0·01	292	†0·00	295	1·35	1,220	4·35	7,900
17	0·76	336	0·71	306	*0·01	292	0·04	307	1·57	1,452	4·30	7,710
18	0·78	348	0·59	251	*0·01	292	0·03	304	1·70	1,595	4·32	7,786
19	0·82	374	†0·58	247	†0·06	313	0·07	316	1·67	1,562	4·15	7,155
20	0·90	430	0·57	243	0·13	334	0·13	334	1·66	1,551	4·00	6,640
21	0·88	416	0·49	211	0·16	344	0·30	400	1·65	1,540	3·98	6,572
22	0·84	388	0·49	211	0·13	334	0·30	400	1·72	1,619	4·38	8,017
23	0·82	374	0·50	215	0·16	344	0·30	400	1·64	1,529	4·60	8,900
24	0·82	374	0·52	223	0·13	334	0·42	460	1·55	1,430	4·40	8,095
25	0·74	324	0·62	263	0·06	313	0·60	555	1·48	1,353	4·53	8,613
26	0·76	336	†0·55	235	†0·06	313	0·65	590	1·41	1,286	3·98	6,572
27	0·85	395	0·47	203	0·06	313	0·64	583	1·36	1,230	3·98	6,572
28	0·93	451	0·41	210	0·05	310	0·64	583	1·32	1,190	4·00	6,640
29	0·95	465	.....	...	0·09	322	0·62	569	1·36	1,230	4·00	6,640
30	0·92	444	.....	...	0·12	331	0·64	583	1·44	1,310	3·95	6,470
31	0·88	416	.....	...	0·09	322	.....	...	1·73	1,631	.....	...

†No observations, gauge height interpolated. *Negative gauge height. Note.—Very good winter Station.

SESSIONAL PAPER No. 25e

Daily Gauge Heights and Discharge of Bow River at Banff, Alta., for 1911. —*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height	Discharge.	Gauge Height	Discharge.	Gauge Height	Discharge.	Gauge Height.	Discharge.	Gauge Height	Discharge.	Gauge Height	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	3·88	6,252	2·78	3,079	2·30	2,120	1·32	885	0·65	425	0·69	445
2	3·88	6,252	2·84	3,225	2·32	2,154	1·32	885	0·67	435	0·72	460
3	3·80	6,025	2·86	3,275	2·38	2,259	1·32	885	0·76	480	0·67	435
4	3·55	5,330	2·88	3,325	2·38	2,259	1·28	845	0·83	518	0·63	415
5	3·27	4,618	2·88	3,325	2·28	2,088	1·27	835	0·80	500	0·58	392
6	3·20	4,450	2·88	3,325	2·18	1,930	1·22	788	0·80	500	0·58	392
7	3·61	5,493	2·85	3,250	2·07	1,773	1·20	770	†0·71	455	0·60	400
8	3·50	5,200	2·86	3,275	2·00	1,675	1·21	779	†0·62	410	0·60	400
9	3·25	4,570	2·75	3,010	1·98	1,649	1·19	761	†0·51	364	0·60	400
10	3·20	4,450	2·65	2,790	1·92	1,574	1·18	752	†0·38	319	0·59	396
11	3·12	4,258	2·58	2,643	1·91	1,562	1·18	752	0·23	276	0·51	364
12	3·05	4,090	2·50	2,480	1·91	1,562	1·18	752	0·20	270	0·57	388
13	2·98	3,922	2·55	2,580	2·10	1,815	1·17	743	0·24	278	0·55	380
14	3·00	3,945	2·48	2,442	1·99	1,662	1·18	752	0·39	322	0·55	380
15	3·22	4,545	2·48	2,442	1·93	1,586	1·18	752	0·56	384	0·51	364
16	3·28	4,700	2·52	2,520	1·89	1,538	1·13	709	0·66	430	0·51	364
17	3·38	4,965	2·45	2,385	1·81	1,442	1·08	671	0·74	470	†0·47	348
18	3·38	4,940	2·48	2,442	1·73	1,346	1·08	671	0·81	506	0·44	337
19	3·14	4,200	2·48	2,442	1·69	1,298	1·04	644	0·80	500	0·49	356
20	3·05	3,915	2·52	2,520	1·62	1,214	1·02	632	0·79	495	0·51	364
21	2·97	3,660	2·44	2,367	1·62	1,214	1·00	620	0·79	495	0·41	328
22	3·10	3,990	2·39	2,277	1·61	1,202	0·99	614	0·63	415	0·51	364
23	3·05	3,840	2·30	2,120	1·59	1,178	0·97	602	0·62	410	0·52	368
24	3·00	3,670	2·27	2,072	1·54	1,119	0·98	608	0·63	400	†0·50	360
25	3·17	4,095	2·28	2,088	1·48	1,053	0·87	542	0·65	425	0·48	352
26	3·29	4,436	2·30	2,120	1·46	1,031	0·75	475	0·62	410	0·41	328
27	3·20	4,180	2·21	1,976	1·41	976	0·79	495	0·52	368	0·40	325
28	2·94	3,475	2·17	1,915	1·40	965	0·76	480	0·53	372	0·41	328
29	2·92	3,425	2·14	1,871	1·38	945	0·72	460	0·55	380	0·61	405
30	2·93	3,450	2·18	1,930	1·37	935	0·72	460	0·67	435	0·66	430
31	2·85	3,250	2·23	2,008			0·70	450			†0·64	420

Monthly Discharge of Bow River at Banff, Alta., for 1911.

Drainage area, 857 square miles.

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	465	210	347	0·405	0·47	21,336
February	537	203	327	0·382	0·40	18,161
March	341	240	302	0·352	0·41	18,569
April	590	268	367	0·428	0·48	21,838
May	1,631	669	1,240	1·45	1·67	76,240
June	9,310	2,595	6,251	7·30	8·14	371,960
July	6,252	3,250	4,438	5·18	5·97	272,878
August	3,325	1,871	2,565	2·99	3·45	157,715
September	2,259	935	1,501	1·75	1·95	89,491
October	885	450	680	0·794	0·92	41,812
November	518	270	415	0·484	0·54	24,691
December	460	325	380	0·443	0·51	23,365
The year					24·91	1,138,062

Discharge Measurements of Bow River at Banff, in 1912.

Date.	Hydrographer.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Jan. 1	V. A. Newhall	53·0	176·5	1·62	1·78	286·0
Jan. 15	do	50·0	164·0	1·92	2·03	314·8
Jan. 26	do	56·0	200·0	1·41	2·08	284·0
Feb. 3	do	51·5	156·4	1·72	1·18	268·4
Feb. 10	do	50·0	150·5	1·83	1·15	275·0
Feb. 17	do	50·0	153·0	1·84	1·24	282·2
Feb. 24	do	50·0	148·0	1·71	1·25	252·5
Mar. 5	do	50·0	145·2	1·60	1·00	230·8
Mar. 14	H. C. Ritchie	52·0	153·8	1·32	0·90	202·7
Mar. 25	do	51·0	139·95	1·65	0·97	230·6
Apr. 8	do	57·5	150·63	1·72	0·90	258·5
Apr. 13	do	60·0	163·0	1·83	1·15	298·1
Apr. 22	do	120·0	475·7	0·64	1·15	307·3
May 7	do	126·0	542·4	0·897	1·44	486·98
May 20	do	284·0	931·0	1·83	1·93	1,702·02
June 4	do	275·5	808·1	1·51	1·53	1,220·45
June 17	do	320·5	1,377·5	3·42	3·40	4,708·92
July 3	do	312·5	1,214·38	2·78	3·00	3,381·25
July 15	do	313·5	1,268·65	2·89	3·00	3,665·88
July 29	do	314·5	1,209·67	2·67	2·80	3,230·90
Aug. 12	do	309·5	1,151·10	2·49	2·20	2,864·87
Aug. 26	do	319·5	1,442·80	3·44	3·60	4,966·10
Sept. 9	do	302·0	1,016·0	2·05	2·25	2,079·00
Sept. 30	H. R. Cram	276·0	820·0	1·42	1·65	1,167·00
Oct. 19	H. C. Ritchie	263·5	760·0	1·25	1·50	951·00
Oct. 31	do	188·0	583·0	0·92	0·90	537·60
Nov. 11	do	195·0	621·8	1·15	1·05	713·00
Nov. 25	do	126·0	534·5	0·88	0·68	472·40
Dec. 9	do	119·0	477·6	0·90	0·63	431·47
Dec. 23	do	115·0	458·2	0·86	0·64	392·59

Daily Gauge Height and Discharge of Bow River, near Banff, for 1912.

Day.	January.		February.		March.		April.		May.		June	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	*1·72	284	1·26	268	1·01	238	1·01	246	1·34	398	1·73	1,336
2	1·76	285	1·21	267	1·00	235	1·06	249	1·31	379	1·66	1,252
3	2·31	286	1·15	265	1·00	233	1·07	251	1·31	379	1·58	1,156
4	2·15	282	1·15	266	1·03	233	1·05	254	1·31	379	1·51	1,080
5	1·75	280	1·12	267	1·01	231	1·00	252	1·38	428	1·44	1,010
6	1·95	282	1·60	283	1·03	228	0·94	252	1·42	456	1·43	1,000
7	1·96	283	1·14	270	1·01	226	0·99	255	1·59	570	1·69	1,288
8	1·96	284	1·14	271	1·00	224	0·99	261	1·84	1,010	2·16	1,904
9	2·20	286	1·12	270	1·00	221	1·01	270	2·08	1,620	2·56	2,599
10	2·42	290	1·15	275	1·00	219	1·04	274	1·05	1,690	2·49	2,452
11	2·20	294	1·15	276	1·00	216	1·15	302	1·98	1,500	2·57	2,610
12	1·99	292	1·12	273	0·98	212	1·11	291	2·02	1,620	2·75	2,990
13	2·00	307	1·12	274	0·98	209	1·13	297	2·27	2,170	3·09	3,832
14	2·00	313	1·10	274	0·98	205	1·13	297	2·25	2,150	2·98	3,528
15	2·03	314	1·12	275	0·98	208	1·13	297	2·29	2,100	3·05	3,720
16	1·75	303	1·16	278	0·86	206	1·11	299	2·37	2,470	3·20	4,140
17	2·12	312	1·22	280	0·90	210	1·14	299	2·30	2,340	3·39	4,680
18	2·35	317	1·22	277	0·91	213	1·13	297	2·12	1,950	3·35	4,569
19	2·12	309	1·25	278	0·86	214	1·15	302	2·00	1,700	3·40	4,710
20	2·12	303	1·14	270	0·86	216	1·15	302	1·92	1,570	3·46	4,890
21	2·00	298	1·24	271	0·87	219	1·15	302	1·89	1,420	3·46	4,890
22	1·96	295	1·21	265	0·88	220	1·15	307	1·89	1,528	3·48	4,950
23	1·94	291	1·29	260	0·86	221	1·15	302	1·88	1,516	3·52	5,070
24	1·78	286	1·25	252	0·86	224	1·20	321	1·86	1,492	3·52	5,070
25	1·71	280	1·20	248	0·97	230	1·22	329	2·04	1,726	3·46	4,890
26	2·02	282	1·18	246	0·94	232	1·22	329	2·24	2,024	3·50	5,010
27	1·95	289	1·10	245	0·95	234	1·22	329	2·49	2,452	3·56	5,192
28	1·75	278	1·00	244	1·00	237	1·21	325	2·32	2,152	3·53	5,100
29	1·55	273	0·97	241	1·00	241	1·26	348	2·10	1,820	3·20	4,140
30	1·40	270	.....	.....	0·96	242	1·34	398	1·98	1,640	3·10	3,860
31	1·34	270	.....	.....	0·96	244	.....	.....	1·84	1,468	.....	.....

*Gauge heights during 1912 are taken from a rod 1·09 lower than that used during 1911.

Daily Gauge Height and Discharge of Bow River, near Banff, for 1912.—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·95	3,450	2·85	3,210	2·66	2,792	1·64	1,228	1·03	648	0·65	435
2	2·88	3,282	2·97	3,502	2·56	2,590	1·63	1,216	1·03	648	0·64	432
3	2·96	3,476	2·90	3,330	2·49	2,452	1·60	1,180	1·10	700	0·77	492
4	2·79	3,078	2·97	3,502	2·45	2,380	1·73	1,336	1·04	654	0·73	468
5	2·81	3,122	2·97	3,502	2·40	2,290	1·66	1,252	1·06	668	0·65	435
6	3·13	3,944	3·01	3,608	2·34	2,184	1·61	1,192	1·08	681	0·64	432
7	3·24	4,252	2·72	2,924	2·27	2,072	1·59	1,168	1·06	668	0·65	435
8	3·30	4,420	2·67	2,814	2·28	2,088	1·59	1,168	1·04	654	0·70	450
9	3·24	4,252	2·73	2,946	2·25	2,040	1·57	1,144	1·07	676	0·74	474
10	3·21	4,168	2·78	3,056	2·23	2,008	1·54	1,110	1·08	684	0·52	396
11	3·17	4,056	2·73	2,946	2·21	1,976	1·51	1,080	1·04	654	0·34	315
12	3·12	3,916	2·67	2,814	2·22	1,992	1·46	1,030	1·03	648	0·51	393
13	3·26	3,308	2·53	2,530	2·25	2,040	1·44	1·010	1·02	642	0·57	411
14	3·25	4,280	2·48	2,434	2·22	1,992	1·43	1,000	1·02	642	0·73	468
15	3·07	3,776	2·48	2,434	2·16	1,904	1·40	970	0·72	465	0·65	435
16	3·02	3,636	2·69	2,858	2·12	1,848	1·42	990	0·93	588	0·55	405
17	2·82	3,144	3·06	3,748	2·07	1,778	1·54	1,100	0·82	522	0·65	435
18	2·76	3,012	3·04	3,692	2·04	1,726	1·53	1,100	0·93	588	0·71	456
19	2·76	3,012	3·06	3,748	2·01	1,684	1·49	1,060	1·04	654	0·70	450
20	2·78	3,056	3·03	3,664	1·95	1,600	1·42	990	0·95	600	0·61	423
21	2·76	3,012	3·06	3,748	1·90	1,540	1·38	950	0·95	600	0·53	399
22	2·77	3,034	3·06	3,748	1·88	1,516	1·34	910	0·94	594	0·58	414
23	2·89	3,306	3·11	3,888	1·88	1,516	1·36	930	0·93	588	0·63	429
24	3·17	4,056	3·37	4,620	1·82	1,444	1·32	890	0·93	588	0·66	438
25	3·28	4,364	3·85	6,140	1·80	1,420	1·28	850	0·66	435	0·56	408
26	3·20	4,140	3·53	5,100	1·77	1,384	1·33	900	0·44	345	0·63	429
27	3·05	3,720	3·30	4,420	1·74	1,348	1·28	850	0·45	360	0·66	438
28	2·80	3,100	3·24	4,252	1·72	1,324	1·26	830	0·60	418	0·63	429
29	2·79	3,078	3·10	3,860	1·66	1,252	1·21	788	0·65	435	0·65	435
30	2·77	3,034	2·93	3,402	1·64	1,228	1·04	654	0·73	468	0·63	429
31	2·79	3,078	2·75	2,990			1·01	636			0·64	432

Monthly Discharge of Bow River at Banff, for 1912.

(Drainage area, 857 square miles.)

Month.	Discharge in Second-Feet.			Run-Off	
	Maximum.	Minimum.	Mean.	Per Square Mile.	Depth in inches on Drainage Area.	Total in Acre-feet.
January	317	270	291	0·34	0·39	17,868
February	283	241	266	0·31	0·34	15,312
March	244	205	224	0·26	0·30	13,767
April	398	246	295	0·34	0·38	17,530
May	2,470	379	1,485	1·73	1·99	91,291
June	5,192	1,090	3,430	4·00	4·46	204,100
July	4,420	3,012	3,566	4·16	4·79	219,260
August	6,140	2,434	3,530	4·12	4·75	217,050
September	2,792	1,228	1,847	2·16	2·41	109,903
October	1,336	636	1,017	1·19	1·37	62,534
November	700	345	584	0·68	0·76	34,750
December	492	315	429	0·50	0·58	26,378
The year					22·52	1,029,743

Discharge Measurements of Spray River, near Banff, in 1910.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1910.		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
July 15	J. C. Keith	108·5	233·82	6·22	1·95	1,452·45
Aug. 10	do	82·5	181·87	5·245	1·45	952·00
Aug. 31	do	77·5	127·23	3·85	·86	490·03
Sept. 22	do	74·5	134·52	4·14	·95	557·16
Oct. 19	H. R. Carscallen	73·0	120·69	3·77	·83	454·59
Nov. 5	do	72·5	100·10	3·12	·54	312·81
Dec. 2	do	57·0	178·35	1·969	·63	231·93
Dec. 24	do	52·0	91·35	2·43	·59	221·69

Daily Gauge Height and Discharge of Spray River, near Banff, for 1910.

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			1·35	862	·85	480	·80	450				
2			1·30	820	·85	480	·80	450				
3			1·25	777	·80	450	·80	450				
4			1·35	862	·80	450	·80	450			1·92	350
5			1·35	862	·80	450	·75	422				
6			1·45	950	·90	510	75	422			1·99	390
7			1·55	1,042	·90	510	·85	480			1·98	380
8			1·45	950	·85	480	·85	480			1·72	260
9			1·45	950	·85	480	·80	450			1·66	235
10			1·45	950	·85	480	·90	510			1·66	235
11			1·50	995	·80	450	·95	545			1·62	220
12			1·45	950	·80	450	·90	510			1·71	255
13			1·45	950	·80	450	·90	510			1·56	200
14			1·40	905	·80	450	·85	480			1·47	170
15	1·95	1,455	1·40	905	·80	450	·85	480			1·52	185
16	1·95	1,455	1·35	862	·85	480	·85	480			1·52	185
17	1·95	1,455	1·30	820	·85	480	·85	480			1·51	180
18	2·00	1,510	1·25	777	·90	510	·85	480			1·54	190
19	1·80	1,290	1·25	777	·90	510	·85	480			1·38	150
20	1·75	1,240	1·25	777	·95	545	·85	480			1·49	175
21	1·75	1,240	1·20	735	·95	545	·80	450			1·52	185
22	1·75	1,240	1·20	735	·95	545	·75	422			1·44	165
23	1·70	1,190	1·15	695	·95	545	·75	422			1·67	240
24	1·60	1,090	1·20	735	·95	545	·70	395			1·62	220
25	1·50	995	1·05	617	·95	545	·75	422			1·77	280
26	1·50	995	·95	545	·90	510	·70	395			1·75	275
27	1·45	950	·95	545	·85	480	·60	345			1·72	260
28	1·40	905	·90	510	·85	480	·60	345			1·80	290
29	1·35	862	·90	510	·85	480	·60	345			1·76	275
30	1·35	862	·85	480	·85	480	·60	345			1·58	210
31	1·35	862	·80	450			·60	345			1·64	230

No observations taken for November.
Ice conditions during December.
Auxiliary Gauge used during month of December.

Monthly Discharge of Spray River, near Banff, for 1910.

Drainage area, 310 square miles.

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage Area.	Total in acre-feet.
July (15-31)	1,510	862	1,153	3·72	2·35	38,876
August	1,042	450	784	2·53	2·92	48,198
September	545	450	490	1·58	1·76	29,157
October	545	345	443	1·43	1·65	27,213
November†						
December (4-31)	390	150	237	·764	·767	12,486
The period						155,930

†No observations taken for November.

Discharge Measurements of Spray River, near Banff, Alta., in 1911.

Date.	Hydrographer.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Jan. 25	H. R. Carscallen	33·5	104·8	1·62	*3·30	170·3
Feb. 15	do	22·5	1·2	2·34	*2·05	143·4
Mar. 8	do	27·5	50·8	2·76	*1·89	140·2
Apr. 8	do	37·5	59·5	1·99	*0·75	118·6
Apr. 28	H. C. Ritchie	60·5	83·7	2·68	*1·02	224·5
May 12	do	74·5	109·8	3·51	*1·35	385·0
June 17	B. Russell	120	356·3	7·05	2·70	2,511
July 3	do	119	315·1	6·98	2·22	2,200
July 15	do	118·5	255·3	5·85	1·80	1,494
July 28	H. C. Ritchie	117·5	303·6	3·48	1·60	1,058
Aug. 19	H. Brown	111	168·7	4·42	1·36	745·8
Sep. 2	do	92·5	148·7	4·45	1·18	661·3
Sept. 22	do	74·5	119·0	3·91	0·89	466·3
Oct. 14	V. A. Newhall	62·5	86·0	3·61	0·70	310·5
Oct. 31	do	40	83·6	3·07	0·36	256·7
Nov. 22	do	35·5	87·4	2·19	0·58	191·1
Dec. 7	do	32·5	85·6	2·40	0·75	201·4

*Auxiliary gauge.

Daily Gauge Height and Discharge of Spray River, near Banff, for 1911.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·58	200	2·47	152	1·94	140	0·85	158	1·07	246	1·90	815
2	1·29	195	2·48	152	1·98	141	†0·80	140	1·10	260	2·20	1,190
3	1·76	198	2·50	153	1·72	135	0·75	122	1·14	278	2·56	1,852
4	2·11	200	2·44	151	1·82	137	0·73	116	1·17	292	2·55	1,830
5	2·07	195	2·45	152	†1·92	140	0·74	119	1·26	335	2·38	1,484
6	2·02	192	2·36	149	2·03	143	0·75	122	1·36	388	2·40	1,520
7	1·78	188	2·25	147	1·93	140	0·77	130	†1·35	382	*1·54	1,520
8	1·82	186	2·30	148	1·99	142	0·77	130	1·35	382	1·53	1,502
9	2·10	188	2·46	152	1·88	139	†0·77	130	1·37	394	1·48	1,412
10	3·92	228	2·36	149	1·88	139	0·78	133	1·36	388	1·52	1,484
11	5·22	255	2·23	147	1·89	139	0·77	130	1·36	388	1·88	1,476
12	4·63	240	2·20	146	†1·94	140	0·77	130	1·35	382	2·26	1,920
13	5·10	246	2·14	145	2·00	142	0·77	130	1·35	382	2·65	2,390
14	5·12	245	2·16	145	1·77	136	0·78	133	†1·35	382	2·45	1,920
15	5·04	240	2·05	143	2·33	149	0·77	130	1·35	382	2·70	2,510
16	4·83	232	2·13	145	2·11	144	†0·76	126	1·38	399	2·65	2,390
17	4·68	226	2·00	142	2·72	157	0·76	126	1·44	436	2·65	2,390
18	4·38	215	1·87	138	2·27	147	0·77	130	1·46	449	2·75	2,640
19	4·23	206	2·10	144	†2·02	142	0·79	136	1·48	462	2·68	2,460
20	4·08	202	2·03	143	1·82	137	0·81	144	1·46	449	2·58	2,220
21	3·99	198	1·99	142	1·49	140	0·87	164	1·45	442	2·52	2,090
22	4·12	198	1·98	141	1·33	140	0·89	172	1·46	449	2·62	2,320
23	3·68	180	2·10	144	1·36	142	†0·92	183	1·46	449	2·70	2,510
24	3·49	175	1·97	141	1·25	148	0·96	199	1·44	436	2·55	2,160
25	3·27	169	†1·98	141	1·12	150	1·01	220	1·38	399	2·65	2,390
26	3·20	168	†1·99	142	†0·98	150	1·02	224	1·37	394	2·35	2,500
27	3·16	167	2·00	142	0·84	154	1·02	224	1·34	377	2·35	2,500
28	3·12	166	1·97	141	0·80	140	1·02	224	1·32	366	2·25	2,260
29	3·00	163	.....	.....	0·82	147	1·01	220	1·33	372	2·25	2,260
30	2·29	161	.....	.....	0·81	144	†1·04	233	1·37	394	2·32	2,428
31	2·64	156	.....	.....	0·79	136	.....	.....	1·55	512	.....	.....

*Readings made at regular gauge after June 7.
†No observations, gauge height interpolated.

Daily Gauge Height and Discharge of Spray River, near Banff, for 1911.—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·28	2,332	1·55	995	1·22	690	0·79	395	0·24	225	0·67	198
2	2·25	2,260	1·56	1,000	1·18	664	0·79	390	0·20	215	0·60	191
3	2·25	2,260	1·58	1,020	1·22	696	0·77	380	0·50	300	0·63	194
4	2·15	2,050	1·58	1,020	1·29	752	0·76	370	0·35	255	0·65	196
5	2·02	1,780	1·56	995	1·22	696	0·76	370	0·36	258	0·69	199
6	1·95	1,660	1·55	980	1·19	672	0·73	355	0·34	252	0·78	201
7	2·20	2,240	1·55	980	1·17	656	0·70	340	†0·36	250	0·72	200
8	1·95	1,690	1·56	985	1·13	624	0·70	335	†0·38	235	0·72	200
9	†1·88	1,580	1·56	985	1·09	593	0·69	330	†0·40	235	0·63	194
10	1·82	1,480	1·54	955	1·07	579	0·69	325	†0·42	230	0·52	188
11	1·82	1,490	1·53	945	1·06	572	0·69	320	0·45	225	0·53	189
12	1·75	1,390	1·50	910	1·06	572	0·70	320	0·54	235	0·68	198
13	1·75	1,400	1·48	880	†1·05	565	0·69	315	0·68	238	0·74	200
14	1·75	1,410	1·47	870	1·05	565	0·69	305	0·62	230	0·75	201
15	1·85	1,590	1·46	850	1·02	544	0·69	310	1·11	258	0·72	200
16	1·85	1,580	1·45	830	0·99	524	0·67	305	1·13	255	0·62	192
17	1·90	1,670	†1·41	795	0·98	518	0·65	305	1·14	250	†0·68	198
18	1·85	1,560	1·37	755	0·96	506	0·64	305	0·95	232	0·74	200
19	1·78	1,430	1·36	745	0·92	482	0·62	300	0·89	225	0·98	218
20	1·70	1,300	1·38	770	0·92	482	0·64	310	0·86	215	0·99	218
21	1·72	1,310	1·36	755	0·91	476	0·61	305	0·72	200	1·02	220
22	1·75	1,350	1·32	725	0·89	465	0·61	310	0·79	202	1·07	222
23	1·72	1,300	1·27	690	0·88	455	0·59	305	0·84	207	0·92	211
24	1·68	1,220	1·24	670	0·88	455	0·59	310	0·78	202	†0·95	213
25	1·72	1,270	1·22	660	0·84	430	0·55	300	0·59	190	0·99	218
26	1·76	1,310	1·27	705	0·84	430	0·54	300	0·52	188	1·45	245
27	1·68	1,180	1·22	670	0·83	425	0·44	270	0·42	180	1·78	260
28	1·62	1,085	1·18	640	0·83	420	0·39	260	0·57	190	1·68	250
29	1·60	1,050	1·17	635	0·82	410	0·37	260	0·68	198	1·10	200
30	1·55	1,000	1·17	640	0·80	400	0·32	240	0·75	201	1·42	220
31	1·54	990	1·18	650	.....	.....	2·07	232	.....	.....	†1·68	235

† No observations, gauge height, interpolated.

Monthly Discharge of Spray River, near Banff, for 1911.

(Drainage area, 310 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum	Minimum	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	255	156	199	0·642	0·74	12,236
February	153	138	146	0·471	0·49	8,108
March	157	135	143	0·461	0·53	8,793
April	233	116	156	0·503	0·56	9,283
May	512	246	389	1·255	1·45	23,919
June	2,640	815	2,011	6·49	7·24	119,660
July	2,332	990	1,523	4·91	5·66	93,646
August	1,020	635	829	2·67	3·08	50,973
September	752	400	544	1·755	1·96	32,370
October	395	232	315	1·016	1·17	19,369
November	300	180	226	0·729	0·81	13,448
December	260	188	209	0·674	0·78	12,851
The year	.....	.....	.....	.....	24·17	404,656

Discharge Measurements of Spray River, near Banff, in 1912.

Date.	Hydrographer.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Jan. 11	V. A. Newhall	26·0	75·40	1·99	5·975	150·0
Jan. 24	do	29·0	78·45	1·92	5·53	150·5
Jan. 30	do	29·0	74·10	1·92	5·66	141·91
Feb. 9	do	28·5	68·60	2·18	5·225	149·50
Feb. 14	do	28·5	58·45	2·44	5·085	142·80
Feb. 26	W. Turnbull	28·5	66·55	1·89	4·995	125·90
Mar. 4	V. A. Newhall	28·5	68·02	1·24	5·00	84·37
Mar. 16	H. C. Ritchie	32·0	81·70	1·44	5·27	117·64
Mar. 30	do	28·5	73·00	1·54	5·10	112·35
April 6	do	30·0	62·87	1·97	4·73	123·80
April 23	do	35·5	62·45	2·41	4·69	150·38
May 6	do	37·5	65·50	2·85	4·79	186·45
May 25	do	116·5	163·25	3·92	5·86	640·28
June 3	do	106·5	139·07	3·72	5·65	517·06
July 17	do	119·5	261·35	5·95	6·85	1,556·28
July 30	do	117·5	214·75	5·21	6·50	1,118·40
Aug. 15	do	116·5	169·80	4·45	6·08	754·70
Aug. 27	do	117·5	187·12	4·65	6·20	871·0
Sept. 10	do	116·5	172·60	4·38	6·00	757·0
Oct. 1	H. R. Cram	115·0	128·0	3·93	5·60	504·0
Oct. 14	do	110·0	113·0	3·73	5·48	420·0
Oct. 30	H. C. Ritchie	47·5	92·9	3·67	5·27	341·0
Nov. 12	do	62·5	95·5	3·34	5·18	319·0
Nov. 27	do	38·5	71·48	2·52	4·94	180·39
Dec. 11	do	33·0	86·95	1·66	5·25	144·20
Dec. 24	do	35·0	108·0	2·09	5·77	225·72

Daily Gauge Height and Discharge of Spray River, near Banff, for 1912.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	6·53	155·0	5·34	144·0	5·08	138·0	4·92	108·0	4·70	152·0	5·79	590·0
2	5·98	150·0	5·36	144·0	4·98	135·0	4·85	108·0	4·72	158·0	*5·70	540·0
3	6·10	151·0	5·75	150·0	*4·98	135·0	4·79	110·0	4·72	158·0	5·69	535·0
4	6·08	151·0	*5·61	149·0	5·34	129·0	4·73	110·0	4·72	158·0	5·63	504·0
5	5·97	150·0	5·61	149·0	5·43	138·0	4·69	110·0	4·73	160·0	5·57	474·0
6	5·87	150·0	5·48	147·0	5·31	126·0	4·79	128·0	4·76	169·0	5·56	469·0
7	*5·80	150·0	5·28	143·0	5·30	125·0	*4·79	128·0	4·82	186·0	5·62	499·0
8	5·71	149·0	5·21	141·0	5·46	141·0	4·63	120·0	4·88	204·0	5·95	690·0
9	6·72	149·0	5·21	141·0	5·25	120·0	4·66	124·0	5·07	267·0	*6·00	724·0
10	6·10	151·0	5·21	141·0	*5·20	115·0	4·68	125·0	5·07	267·0	6·30	943·0
11	5·97	150·0	*5·21	141·0	5·08	103·0	4·65	126·0	5·07	267·0	6·34	877·0
12	6·00	150·0	5·23	142·0	5·10	105·0	4·65	128·0	*5·35	374·0	6·44	1,065·0
13	5·90	150·0	5·16	140·0	5·02	97·0	4·65	130·0	5·42	403·0	6·66	1,306·0
14	*5·90	150·0	5·06	137·0	4·97	92·0	*4·65	132·0	5·66	519·0	6·66	1,306·0
15	5·95	150·0	5·04	137·0	5·04	99·0	4·66	134·0	6·02	738·0	6·75	1,420·0
16	6·25	152·0	5·57	148·0	5·24	119·0	4·66	135·0	6·26	912·0	*6·80	1,485·0
17	5·75	150·0	5·19	141·0	*5·20	115·0	4·65	135·0	6·22	881·0	7·55	2,530·0
18	5·60	149·0	*5·19	141·0	5·05	100·0	4·66	136·0	6·06	765·0	7·45	2,390·0
19	5·60	149·0	5·25	142·0	5·02	97·0	*4·66	136·0	*6·05	758·0	7·41	2,348·0
20	5·61	149·0	5·08	138·0	5·01	96·0	4·67	136·0	5·98	710·0	7·43	2,362·0
21	*5·61	149·0	5·16	140·0	4·96	91·0	4·67	141·0	5·94	683·0	7·40	2,320·0
22	5·63	149·0	5·15	140·0	4·96	91·0	4·66	141·0	5·83	614·0	7·29	2,166·0
23	5·57	148·0	5·16	140·0	4·88	83·0	†4·67	150·0	5·83	614·0	*7·29	2,166·0
24	5·52	147·0	5·06	137·0	*4·88	83·0	4·69	149·0	5·82	608·0	7·29	2,166·0
25	5·61	149·0	*5·05	137·0	4·91	86·0	4·72	158·0	5·84	620·0	7·08	1,872·0
26	5·55	148·0	5·03	136·0	4·89	89·0	4·72	158·0	*6·20	865·0	7·15	1,970·0
27	6·40	155·0	4·97	135·0	4·89	89·0	4·71	155·0	6·23	888·0	7·12	1,928·0
28	*6·20	152·0	4·90	132·0	4·84	79·0	4·70	152·0	6·17	842·0	6·99	1,746·0
29	5·93	150·0	4·90	132·0	†4·80	75·0	4·71	155·0	6·05	758·0	6·75	1,420·0
30	5·64	149·0			*5·24	124·0	4·70	152·0	5·95	690·0	*6·60	1,234·0
31	5·47	146·0			*5·24	135·0			5·87	638·0		

* Gauge Heights interpolated.
† Shifting conditions from March 30 to April 23.

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Daily Gauge Height and Discharge of Spray River, near Banff, for 1912 — *Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	6·64	1,282	6·43	1,056	*6·05	758	5·59	484	5·24	330	5·35	260
2	6·56	1,188	*6·40	1,028	6·01	731	5·61	494	5·21	318	5·49	395
3	6·68	1,331	*6·38	1,011	5·98	710	5·59	484	*5·22	322	5·49	395
4	6·57	1,200	*6·36	994	5·95	690	5·67	524	5·23	326	5·56	394
5	6·58	1,211	6·35	985	*5·93	676	5·62	499	5·21	318	5·85	318
6	6·60	1,234	6·33	968	5·91	663	*5·60	489	5·22	322	6·07	256
7	*6·75	1,420	6·20	865	5·90	656	5·58	479	5·20	314	5·72	209
8	6·91	1,634	6·20	865	*5·95	690	5·59	484	5·19	310	5·65	180
9	7·03	1,802	6·18	857	6·01	731	5·58	479	5·22	322	5·55	160
10	7·00	1,760	6·16	834	6·02	738	5·56	469	*5·20	314	5·45	152
11	7·00	1,760	*6·18	857	6·02	738	5·53	454	5·19	310	5·25	144
12	6·99	1,746	6·20	865	6·06	765	5·50	439	5·19	310	5·86	184
13	7·00	1,760	6·15	826	6·15	826	*5·50	439	5·20	311	5·87	190
14	*7·00	1,760	6·10	792	6·13	812	5·49	434	5·20	308	5·75	208
15	*7·00	1,760	6·06	765	*6·06	765	5·46	421	5·10	267	5·65	184
16	7·05	1,830	6·15	826	6·00	724	5·47	425	5·11	267	5·56	223
17	6·86	1,564	6·34	977	5·98	710	5·40	395	5·15	278	5·80	218
18	6·73	1,394	*6·34	977	5·93	676	5·52	449	5·13	267	5·84	215
19	6·68	1,331	6·34	977	5·93	676	5·51	444	5·11	257	5·72	179
20	6·62	1,258	6·31	951	5·86	632	*5·45	416	5·12	260	5·84	164
21	*6·55	1,176	6·32	960	5·83	614	5·41	399	5·11	257	5·76	148
22	6·51	1,135	6·31	951	*5·82	608	5·41	399	5·09	243	5·80	194
23	6·48	1,105	6·30	943	5·80	596	5·41	399	5·10	248	5·88	250
24	6·50	1,125	6·32	960	5·76	572	5·41	399	5·00	210	5·77	226
25	6·72	1,382	*6·30	943	5·75	566	5·40	395	4·92	180	5·63	210
26	6·67	1,319	6·25	904	5·71	545	5·36	378	4·80	144	6·03	334
27	6·68	1,331	6·20	865	5·69	535	*5·35	374	5·02	188	5·92	324
28	*6·60	1,234	6·21	873	5·66	519	5·33	366	4·98	174	5·81	278
29	6·53	1,156	6·20	865	*5·64	509	5·25	334	5·18	229	5·78	284
30	6·47	1,094	6·12	806	5·62	499	5·22	322	5·27	243	5·75	269
31	6·44	1,065	6·08	778			5·21	318			5·70	243

* Gauge heights interpolated.

Monthly Discharge of Spray River, near Banff, for 1912.

(Drainage area, 310 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum	Mean	Per Square Mile	Depth in inches on Drainage Area.	Total in Acre-feet.
January	155	146	150	0·48	0·55	9,217
February	150	132	141	0·45	0·48	8,104
March	141	75	108	0·35	0·40	6,641
April	158	108	134	0·43	0·48	7,950
May	942	152	517	1·67	1·92	31,789
June	2,530	169	1,405	4·05	4·52	83,590
July	1,830	1,065	1,398	4·51	5·20	85,960
August	1,056	778	907	2·93	3·38	55,781
September	826	499	664	2·14	2·39	39,529
October	524	318	428	1·38	1·59	26,348
November	330	144	272	0·88	0·98	16,161
December	395	144	237	0·76	0·88	14,551
The year					22·77	385,624

Discharge Measurements of Cascade River at Bankhead, Alta., in 1911.

Date.	Hydrographer.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Jan. 27	H. R. Carscallen	27	45·0	2·72	....	122·0
Feb. 14	do	27	35·8	2·82	....	101·0
Mar. 7	do	27	34·1	2·84	....	97·1
Mar. 24	do	42	53·2	2·10	....	111·8
Apr. 26	H. C. Ritchie	49	55·5	2·09	....	116·2
Aug. 16	H. Brown	45·1	144·3	4·95	1·58	714·2
Aug. 21	do	45·1	141·3	4·38	1·46	618·7
Sept. 1	do	44·6	127·8	3·89	1·36	496·4
Sept. 19	do	44·8	123·7	3·84	1·19	381·5
Oct. 16	V. A. Newhall	44·8	126·0	1·97	1·04	248·6
Nov. 6	do	45	100·1	1·79	0·89	178·8
Nov. 23	do	43·5	99·4	1·55	....	154·1*
Dec. 8	do	38	89·0	1·56	0·73	139·3
Dec. 22	do	43·3	114·1	0·90	1·73	103·0

*No gauge.

Daily Gauge Height and Discharge of Cascade River at Bankhead, Alta., for 1911.

Day.	August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			1·35	486	1·08	296	0·84	160		
2			1·34	480	1·07	287	0·85	163		
3			1·36	500	1·06	280	0·85	163		
4			1·35	493	1·05	274	0·86	167		
5			1·35	496	1·04	267	0·87	171		
6			1·35	499	1·04	264	0·88	175		
7			1·35	501	1·03	258	0·90		‡	
8			1·33	484	1·03	257	0·93		0·73	
9			1·32	478	1·03	256	0·98		0·75	
10			1·30	461	1·02	247	1·08		0·92	
11			1·30	464	1·02	246	1·26		1·22	
12			1·28	417	1·02	244	1·50		1·42	
13			1·27	440	1·03	250	1·68		1·62	
14			1·26	434	1·01	238	1·75		1·97	
15			1·26	436	1·01	236	1·75		2·27	
16	1·58	714	1·25	428	1·00	228	1·73		2·52	
17	†1·56	701	1·24	420	0·99	223	1·45		2·72	
18	†1·53	675	1·22	405	0·98	218			3·02	
19	1·50	649	1·20	390	0·97	214			2·97	
20	1·48	634	1·18	374	0·96	209			2·57	
21	1·46	619	1·16	360	0·96	209			2·27	
22	1·50	659	1·14	343	0·94	200			1·87	
23	1·50	656	1·12	328	0·93	196			1·52	
24	1·48	633	1·12	328	0·92	191			1·52	
25	1·50	651	1·11	320	0·91	187			1·77	
26	1·50	648	1·10	313	0·90	183			1·77	
27	1·46	606	1·10	313	0·89	179			1·77	
28	1·44	583	1·09	304	0·87	171			1·82	
29	1·40	541	1·09	304	0·86	167			1·82	
30	1·38	520	1·08	298	0·85	163			1·67	
31	1·36	499			0·83	156			1·57	

†No observation, gauge height interpolated.
‡Gauge carried away by ice on Nov. 18. Replaced Dec. 9.
Note.—Not sufficient data to compute daily discharges after Nov. 6.

SESSIONAL PAPER No. 25e

Monthly Discharge of Cascade River at Bankhead, Alta., for 1911.

(Drainage area, 218 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
August (16-31)	714	499	624	2·516	1·50	19,803
September	501	298	411	1·657	1·85	24,456
October	296	156	226	0·911	1·05	13,896
November (1-6)	175	160	166	0·669	0·15	1,976
The period					4·55	60,131

Discharge Measurements of Cascade River at Bankhead, in 1912.

Date.	Hydrographer.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Jan. 29	V. A. Newhall	45·5	164·2	0·66	3·03	108·4
Feb. 8	do	43·0	163·7	0·75	3·21	122·3
Feb. 20	do	24·5	22·6	1·83	2·91	41·4
Feb. 27	do	18·5	19·1	3·37	1·78	64·5
Mar. 27	H. C. Ritchie	46·0	81·1	0·86	1·36	69·6
April 12	do	46·0	76·3	0·76	1·32	57·7
April 26	do	44·0	74·6	0·77	1·34	57·3
May 8	do	46·0	100·9	1·73	1·81	174·2
May 21	do	49·0	104·3	2·52	1·97	262·6
June 7	do	44·0	66·6	0·71	1·24	47·3
June 18	do	53·3	182·8	7·92	3·30	1,446·0
July 17	do	39·5	42·4	0·39	0·84	16·4
July 30	do	35·0	44·5	0·34	0·84	15·4
Aug. 17	do	49·0	158·2	7·35	2·96	1,162·1
Aug. 28	do	57·3	192·3	7·48	3·65	1,439·0
Sept. 11	do	59·1	187·0	6·23	3·30	1,164·6
Oct. 2	H. R. Cram	55·2	124·0	2·39	2·48	296·0
Oct. 21	H. C. Ritchie	51·0	121·6	2·01	2·35	244·8
Oct. 29	do	52·0	126·2	2·08	2·35	262·6
Nov. 15	do	51·4	109·8	1·37	2·08	150·6
Nov. 29	do	56·0	146·1	3·02	2·66	447·9
Dec. 12	do	57·0	142·0	2·70	2·58	383·4
Dec. 31	do	52·0	118·4	1·84	2·25	218·0

Daily Gauge Height and Discharge of Cascade River at Bankhead, for 1912.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·32	80·8	2·82	101·0	2·42	84·8	1·23	42·6	1·37	61·2	(3)	Nil.
2	2·17	74·8	2·77	99·8	2·52	88·8	1·70	135·0	1·39	64·4	1·45	75·0
3	2·07	70·8	2·72	96·8	2·62	92·8	1·98	261·0	1·43	71·4	1·45	75·0
4	2·27	78·8	2·67	94·8	2·67	194·8	1·58	102·0	1·45	75·0	1·43	71·4
5	(1)	.....	2·62	92·8	3·04	110·0	1·25	45·0	1·55	95·0	(3)	Nil.
6	.....	.....	2·57	90·8	3·05	110·0	1·25	45·0	1·55	95·0	1·10	29·0
7	(5)	.....	3·28	119·0	3·77	139·0	1·26	45·2	1·62	111·6	1·24	43·8
8	5·21	196·0	3·22	117·0	3·57	131·0	1·24	43·8	1·82	181·2	2·00	272·0
9	5·42	205·0	3·15	114·0	3·55	130·0	1·33	55·2	1·90	220·0	1·20	39·0
10	5·45	206·0	2·77	98·8	3·07	111·0	1·35	58·0	1·29	230·0	1·55	95·0
11	5·45	206·0	2·60	92·0	2·72	96·8	1·35	58·0	1·96	250·0	1·75	152·0
12	5·42	205·0	2·47	86·8	2·42	84·8	1·32	53·8	1·99	267·0	1·90	220·0
13	4·77	179·0	2·32	80·8	2·72	96·8	1·33	55·2	2·10	235·0	2·20	405·0
14	4·47	167·0	2·25	78·0	2·67	94·8	1·34	56·6	2·22	421·0	2·65	792·0
15	4·27	159·0	2·30	80·0	3·07	111·0	1·35	58·0	2·28	467·0	2·47	626·0
16	3·87	143·0	2·22	76·8	2·67	94·8	1·41	67·8	2·36	532·0	3·15	1287·0
17	3·62	133·0	2·17	74·8	2·37	82·8	1·41	67·8	2·28	467·0	3·33	1478·0
18	3·72	137·0	2·12	72·8	1·79	61·6	1·42	69·6	2·20	405·0	3·35	1500·0
19	3·77	139·0	2·07	70·8	1·97	66·8	1·38	62·8	2·25	444·0	3·31	1456·0
20	4·37	163·0	2·02	68·8	1·87	63·8	1·35	58·0	2·07	316·0	3·29	1434·0
21	5·01	188·0	2·41	84·4	(2)	.....	1·31	52·4	2·10	335·0	3·25	1390·0
22	5·32	201·0	2·14	73·4	.....	.....	1·28	48·6	2·13	355·0	3·25	1390·0
23	5·35	202·0	2·10	72·0	.....	.....	1·35	58·0	2·12	349·0	3·22	1359·0
24	5·17	195·0	2·07	70·8	.....	.....	1·35	58·0	2·15	369·0	3·20	1338·0
25	3·67	135·0	1·77	60·8	.....	.....	1·35	58·0	2·20	405·0	3·15	1287·0
26	3·62	133·0	1·82	62·8	.....	.....	1·35	58·0	2·25	444·0	3·10	1230·0
27	3·47	127·0	1·78	61·2	1·36	59·6	1·34	56·6	2·33	508·0	3·00	1135·0
28	3·27	119·0	2·52	88·8	2·05	303·0	1·34	56·6	2·28	467·0	2·00	272·0
29	3·11	112·0	2·57	90·8	1·53	91·0	1·32	58·8	2·20	405·0	(4)	.....
30	2·92	105·0	.....	.....	1·48	81·0	1·33	55·2	2·10	335·0	.....	.....
31	2·87	103·0	.....	.....	1·35	58·0	.....	.....	1·98	261·0	.....	.....

(1)—Ice flooded.
(2)—Rod carried out by ice.
(3)—Dam closed.—River dry.
(4)—River practically dry.
(5)—Extreme fluctuations caused by dam above station.

Daily Gauge Height and Discharge of Cascade River at Bankhead, for 1912.—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	†	15·00	0·78	13	2·15	174	2·46	308	2·65	437	2·60	398
2	†	14·80	0·79	14	2·15	174	2·46	308	2·66	445	2·53	359
3	†	14·80	0·75	10	2·14	171	2·46	308	2·64	429	2·49	326
4	†	14·80	0·77	12	2·13	168	2·46	308	2·45	302	2·45	302
5	†	14·70	0·78	13	2·15	174	2·47	314	2·25	212	2·30	232
6	†	14·60	0·78	10	2·15	174	2·47	314	2·28	224	2·15	174
7	1·15	34·	0·75	10	. . .	Nil.	2·46	308	2·25	212	2·20	193
8	3·15	1,287	0·78	13	. . .	Nil.	2·46	308	2·25	212	2·18	186
9	3·25	1,390	1·65	120	3·35	1,132	2·45	302	2·28	224	2·17	182
10	2·75	888	2·03	291	3·28	1,061	2·45	302	2·27	220	2·15	174
11	3·35	1,500	2·08	322	2·02	135	2·43	292	2·27	220	2·75	522
12	3·22	1,359	2·06	309	2·10	157	2·42	287	2·27	220	2·60	398
13	3·12	1,256	2·20	405	2·22	201	2·38	267	2·28	224	2·58	384
14	3·08	1,216	2·50	654	2·48	320	2·33	245	2·11	160	2·50	332
15	3·09	1,205	2·55	700	2·50	332	2·32	240	2·07	149	2·45	302
16	†	17·0	2·93	1,065	2·60	398	2·30	232	2·12	164	2·42	286
17	†	16·44	*2·97	1,105	2·62	414	2·31	236	2·30	232	2·45	302
18	†	16·32	3·47	1,695	2·65	437	2·35	253	2·70	479	2·70	479
19	†	16·12	3·55	1,650	1·30	29	2·36	258	1·95	117	2·68	461
20	†	16·00	3·55	1,625	1·35	32	2·37	262	1·93	113	2·64	429
21	†	15·90	3·53	1,560	2·45	302	2·36	258	1·90	107	2·60	398
22	†	15·90	3·53	1,525	2·37	262	2·36	258	1·90	107	2·55	362
23	†	15·80	3·50	1,450	2·43	292	2·35	253	1·95	117	2·50	332
24	†	15·70	3·42	1,330	2·45	302	2·35	253	1·97	122	2·43	292
25	†	15·60	3·44	1,325	2·46	308	2·35	253	2·30	232	2·75	522
26	†	15·60	3·51	1,395	2·45	302	2·35	253	2·95	724	2·40	276
27	†	15·45	3·73	1,570	2·46	308	2·35	253	2·95	724	2·35	253
28	†	15·40	*3·65	1,413	2·45	302	2·35	253	2·95	724	2·31	236
29	†	15·38	3·55	1,336	2·46	308	2·35	253	2·66	445	2·25	212
30	0·84	15·39	3·50	1,285	2·46	308	2·47	314	2·62	414	2·27	220
31	0·72	8·50	2·15	174	. . .	. . .	2·53	362	. . .	. . .	2·25	212

* Changing conditions from Aug. 17 to Aug. 28.
† Gauge not read. Discharge estimated.
? Irregularities in July Discharge due to operation of dam above.

Monthly Discharge of Cascade River at Bankhead, for 1912.

(Drainage area, 248 square miles.)

Month.	Discharge in Second-Feet.			Run-Off.	
	Maximum.	Minimum.	Mean.	Per Square Mile.	Depth in inches on Drainage Area.	Total in Acre-feet.
January (14, 8-31)	206·0	70·8	148·7	0·61	0·62	8,258
February	119·0	66·8	85·2	0·34	0·37	4,931
March (1-21, 27-31)	303·0	58·0	114·6	0·41	0·38	5,038
April	261·0	42·6	66·6	0·27	0·30	3,963
May	532·0	62·1	301·4	1·22	1·41	18,532
June	1,500·0	Nil.	648·4	2·61	2·91	38,583
July	1,500·0	8·5	337·8	1·36	1·57	20,767
August	1,695·0	10·0	788·0	3·18	3·67	48,452
September	437·0	Nil.	289·2	1·17	1·31	17,209
October	1,362·0	232·0	278·0	1·12	1·29	17,091
November	724·0	107·0	290·4	1·17	1·31	17,280
December	522·0	74·0	313·8	1·27	1·46	19,295
The period	. . . . .	. . . . .	. . . . .	. . . . .	16·61	219,372

Discharge Measurements of Devil's Creek, near Bankhead, in 1910.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge
1910.		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
June 4	J. C. Keith	23	35·25	3·65	.....	128·65
" 18	do	25	44·10	4·25	1·96	187·23
July 18	do	24	33·26	3·43	1·73	113·96
Aug. 10	do	25	41·16	3·93	1·86	161·92
Sept. 1	do	24	29·30	2·77	1·58	84·89
" 23	do	24	31·60	3·034	1·63	95·90
Oct. 18	H. R. Carscallen	24	30·75	2·78	1·52	85·54
Nov. 7	do	24	26·92	2·579	1·42	69·53
Dec. 3	do	24	25·80	2·403	1·34	61·99
" 28	do	24	27·12	2·179	1·16	59·10

Daily Gauge Height and Discharge of Devil's Creek, near Bankhead, for 1910.

Day.	June.		July.		August.		September.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	1·90	163	1·57	87·3	1·58	88·7
2	.....	.....	1·89	160	1·57	87·3	1·56	85·9
3	.....	.....	1·84	143	1·57	87·3	1·56	85·9
4	.....	.....	1·85	146	1·56	85·9	1·56	85·9
5	.....	.....	1·85	146	1·65	99·5	1·59	90·1
6	.....	.....	1·80	131	1·81	134	1·60	91·5
7	.....	.....	1·78	126	1·86	149	1·60	91·5
8	.....	.....	1·78	126	1·86	149	1·62	94·7
9	.....	.....	1·78	126	1·87	153	1·60	91·5
10	.....	.....	1·78	126	1·86	149	1·58	88·7
11	.....	.....	1·76	121	1·85	146	1·59	90·1
12	.....	.....	1·76	121	1·84	143	1·58	88·7
13	.....	.....	1·75	118·5	1·81	134	1·58	88·7
14	.....	.....	1·74	116·4	1·81	134	1·57	87·3
15	.....	.....	1·72	112·2	1·80	131	1·57	87·3
16	.....	.....	1·72	112·2	1·81	134	1·56	85·9
17	.....	.....	1·72	112·2	1·81	134	1·56	85·9
18	.....	.....	1·70	108	1·76	121	1·59	90·1
19	1·95	183	1·69	106·3	1·73	114·3	1·62	94·7
20	2·00	204	1·69	106·3	1·71	110·1	1·64	97·9
21	2·02	213	1·68	104·6	1·69	106·3	1·64	97·9
22	2·00	204	1·65	99·5	1·66	101·2	1·64	97·9
23	1·97	191	1·64	97·9	1·68	104·6	1·64	97·9
24	1·96	187	1·62	94·7	1·65	99·5	1·64	97·9
25	1·96	187	1·59	90·1	1·64	97·9	1·62	94·7
26	1·94	179	1·59	90·1	1·62	91·7	1·60	91·5
27	1·95	183	1·59	90·1	1·60	91·5	1·60	91·5
28	1·95	183	1·59	90·1	1·58	88·7	1·63	96·3
29	1·94	179	1·59	90·1	1·58	88·7	1·58	88·7
30	1·92	171	1·59	90·1	1·60	91·5	1·55	84·5
31	.....	.....	1·59	90·1	1·60	91·5	...	...

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Daily Gauge Height and Discharge of Devil's Creek, near Bankhead, for 1910.—*Continued.*

Day.	October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·58	88·7	1·39	66·5	1·28	56·4
2	1·57	87·3	1·36	63·5	1·32	59·8
3	1·56	85·9	1·38	65·5	1·30	58
4	1·56	85·9	1·39	66·5	1·25	54
5	1·52	80·9	1·36	63·5	1·24	53
6	1·53	82·1	1·40	67·5	1·25	54
7	1·57	87·3	1·40	67·5	1·24	53
8	1·53	82·1	1·38	65·5	1·20	50
9	1·55	84·5	1·38	65·5	1·33	60·7
10	1·56	85·9	1·37	64·5	1·25	54
11	1·56	85·9	1·37	64·5	1·19	49
12	1·53	82·1	1·38	65·5	1·15	46
13	1·51	79·7	1·36	63·5	1·12	44
14	1·47	74·9	1·37	64·5	1·20	50
15	1·48	76·1	1·37	64·5	1·25	54
16	1·48	76·1	1·37	64·5	1·18	49
17	1·49	77·3	1·36	63·5	1·20	51
18	1·51	79·7	1·36	63·5	1·20	52
19	1·48	76·1	1·36	63·5	1·18	51
20	1·46	73·7	1·33	60·7	1·20	54
21	1·45	72·5	1·37	64·5	1·16	52
22	1·45	72·5	1·37	64·5	1·15	52
23	1·42	69·5	1·35	62·5	1·14	52
24	1·41	68·5	1·36	63·5	1·18	58
25	1·46	73·7	1·35	62·5	1·18	59
26	1·42	69·5	1·35	62·5	1·20	61
27	1·41	68·5	1·33	60·7	1·13	56
28	1·38	65·5	1·30	58·0	1·11	55
29	1·37	64·5	1·30	58·0	1·12	56
30	1·39	66·5	1·30	58·0	1·11	55
31	1·37	64·5			1·10	54

Ice conditions from Dec. 16th to Dec. 31st.

Monthly Discharge of Devil's Creek, near Bankhead, for 1910.

(Drainage area, 58 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean	Per square mile	Depth in inches on Drainage area.	Total in acre-feet.
June (19-30	213	171	88·7	3·26	1·45	4,490
July	163	90·1	114·7	1·98	2·28	7,052
August	153	87·3	114·1	1·96	2·26	7,017
September	97·9	84·5	90·66	1·56	1·74	5,394
October	88·7	64·5	77·03	1·33	1·53	4,736
November	67·5	58·0	63·63	1·09	1·22	3,786
December	61	11·	53·64	·925	1·06	3,298
The period						35,773

Discharge Measurements of Devil's Creek, near Bankhead, Alta., in 1911.

Date.	Hydrographer.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Jan. 27	H. R. Carscallen	24	26·9	2·41	1·11	64·9
Feb. 14	do	24	24·4	1·59	1·07	38·8
Mar. 7	do	24	22·2	1·85	1·01	41·0
Mar. 24	do	24	19·4	1·76	0·94	34·2
Apr. 26	H. C. Ritchie	24	20·1	1·93	1·03	38·9
May 10	do	24	22·2	2·10	1·15	46·5
June 2	B. Russell	24	35·8	3·15	1·53	112·9
June 17	do	24	55·0	4·33	1·96	238·4
July 15	do	25	49·4	4·13	1·87	204·0
Aug. 16	H. Brown	25	50·4	4·20	1·88	211·8
Sept. 1	do	25	46·6	3·84	1·79	179·0
Sept. 19	do	25	46·5	3·64	1·78	171·1
Oct. 16	V. A. Newhall	25	40·1	3·05	1·56	122·1
Nov. 6	do	24	33·4	2·78	1·42	92·9
Nov. 23	do	24	30·8	2·38	1·26	73·3
Dec. 8	do	24	28·6	2·37	1·26	67·7
Dec. 22	do	22	20·4	1·76	1·22	36·0
Dec. 27	do	20·5	21·9	1·77	1·27	38·8

Daily Gauge Height and Discharge of Devil's Creek, near Bankhead, for 1911.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·02	49	1·13	60	1·09	44	1·02	38	1·06	41	1·45	98
2	0·96	45	1·13	56	1·06	43	1·02	38	1·06	41	1·54	116
3	0·91	42	1·12	56	1·07	43	1·01	38	1·07	41	1·66	144
4	0·88	40	1·10	53	1·05	43	1·02	38	1·07	41	1·66	144
5	0·88	40	1·11	53	1·16	44	1·03	39	1·07	41	1·67	146
6	0·91	42	1·12	53	1·02	41	1·02	38	1·10	43	1·68	149
7	0·93	44	1·10	50	1·03	42	1·01	38	1·10	43	1·70	154
8	0·92	44	1·11	49	1·05	43	1·00	37	1·11	41	1·68	149
9	0·91	43	1·12	49	1·05	43	1·01	38	1·09	42	1·66	144
10	0·97	47	1·08	44	1·00	39	1·01	38	1·10	43	1·68	149
11	1·01	50	1·08	43	1·00	39	1·01	38	1·12	47	1·71	157
12	1·06	55	1·06	41	1·00	39	1·01	38	1·14	49	1·77	174
13	1·09	58	1·08	40	1·00	39	1·01	38	1·18	52	1·86	201
14	1·08	57	1·07	39	1·02	40	1·01	38	1·20	55	1·92	223
15	1·10	59	1·08	40	1·00	39	1·00	37	1·20	56	1·96	238
16	1·11	61	1·07	39	1·00	39	0·80	28	1·23	59	1·99	251
17	1·11	61	1·07	40	0·96	37	0·90	32	1·24	61	1·99	251
18	1·10	60	1·08	40	0·95	36	1·00	37	1·23	61	1·99	251
19	1·10	60	1·08	41	1·00	38	1·00	37	1·25	65	2·01	259
20	1·12	62	1·08	41	0·96	36	1·00	37	1·24	65	1·99	251
21	1·16	67	1·06	40	0·96	36	1·00	37	1·24	66	1·98	247
22	1·18	69	1·09	42	0·95	35	1·00	37	1·25	67	1·97	247
23	1·17	68	1·08	41	0·97	36	1·01	38	1·33	76	1·97	242
24	1·17	68	1·07	42	1·00	37	1·00	37	1·32	76	2·06	281
25	1·10	62	1·09	43	1·00	37	1·00	37	1·33	78	2·07	286
26	1·10	63	1·07	42	0·90	32	1·02	38	1·34	80	2·06	281
27	1·12	65	1·10	44	0·60	21	1·05	40	1·33	80	2·06	281
28	1·20	72	1·07	43	0·50	19	1·04	39	1·34	81	2·08	290
29	1·15	65	.....	.....	0·80	28	1·05	40	1·30	77	2·08	290
30	1·15	64	.....	.....	1·00	37	1·05	40	1·33	81	2·09	295
31	1·13	61	.....	.....	1·02	38	.....	.....	1·39	89	.....	.....

Daily Gauge Height and Discharge of Devil's Creek, near Bankhead, for 1911.—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·02	264	1·70	154	1·79	179	1·68	149	1·47	102	1·31	76
2	2·00	255	1·72	160	1·77	174	1·68	149	1·46	100	1·33	78
3	2·01	259	1·75	168	1·80	182	1·66	144	1·45	98	1·33	78
4	1·99	251	1·78	176	1·88	208	1·65	141	1·46	100	1·29	73
5	1·99	251	1·79	179	1·90	215	1·61	131	1·46	100	1·31	74
6	1·98	247	1·83	191	1·89	211	1·61	131	1·45	98	1·21	64
7	1·98	247	1·88	208	1·88	208	1·61	131	1·45	98	1·34	76
8	1·97	242	1·90	215	1·88	208	1·60	129	1·47	102	1·28	69
9	1·93	226	1·92	223	1·88	208	1·60	129	1·47	102	1·29	69
10	1·91	219	1·93	226	1·86	201	1·61	131	1·45	98	1·26	64
11	1·89	211	1·90	215	1·86	201	1·59	127	1·42	93	1·25	61
12	1·88	208	1·88	208	1·85	197	1·59	127	1·40	90	1·29	63
13	1·88	208	1·90	215	1·81	185	1·59	127	1·39	89	1·22	54
14	1·87	204	1·89	211	1·80	182	1·57	122	1·40	90	1·25	54
15	1·85	197	1·91	219	1·80	182	1·55	118	1·35	83	1·11	42
16	1·83	191	1·89	211	1·78	176	1·56	120	1·37	86	1·25	50
17	1·83	191	1·87	204	1·78	176	1·54	116	1·36	84	1·22	46
18	1·83	191	1·88	208	1·78	176	1·55	118	1·39	89	1·21	43
19	1·82	188	1·89	211	1·78	176	1·55	118	1·39	89	1·22	42
20	1·79	179	1·88	208	1·78	176	1·54	116	†1·39	89	1·10	34
21	1·79	179	1·87	204	1·78	176	1·53	114	1·36	84	1·08	31
22	1·79	179	1·89	211	1·77	174	1·54	116	1·35	83	1·22	36
23	1·78	176	1·86	201	1·77	174	1·54	116	1·30	77	1·22	36
24	1·78	176	1·84	194	1·73	162	1·52	112	1·33	81	1·28	40
25	1·77	174	1·88	208	1·70	154	1·52	112	1·33	81	1·28	40
26	1·73	162	1·89	211	1·69	151	1·50	108	1·36	84	1·28	40
27	1·71	157	1·87	204	1·69	151	1·50	108	1·38	86	1·27	39
28	1·71	157	1·85	197	1·68	149	1·47	102	1·37	84	1·22	36
29	1·69	151	1·80	182	1·66	144	1·47	102	1·38	85	1·21	36
30	1·69	151	1·79	179	1·67	146	1·47	102	1·29	74	1·21	36
31	1·68	149	1·78	176			1·47	102			†1·21	36

† No observation, gauge height interpolated.

Monthly Discharge of Devil's Creek, near Bankhead, Alta., for 1911.

(Drainage area, 58 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	72	40	56·2	0·969	1·12	3,456
February	60	39	45·2	0·779	0·81	2,510
March	44	19	37·5	0·647	0·75	2,306
April	40	28	37·4	0·645	0·72	2,226
May	89	41	59·4	1·024	1·18	3,652
June	295	98	213	3·672	4·10	12,674
July	264	149	201	3·466	4·00	12,359
August	226	154	199	3·431	3·96	12,236
September	215	144	180	3·103	3·46	10,711
October	149	102	122	2·103	2·42	7,504
November	102	74	90·0	1·551	1·73	5,355
December	78	31	52·1	0·898	1·04	3,204
The year					25·29	78,190

Discharge Measurements of Kananaskis River, near Kananaskis, Alta., for 1911.

Date.	Hydrographer.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Feb. 11	H. R. Carscallen	35	66·8	1·97	.....	131·7
Mar. 4	do	32	58·4	1·87	.....	109·4
Mar. 22	do	32	56·1	2·19	.....	122·8
Sept. 6	H. Brown	63·5	178·6	5·68	7·03	1,014·7
Sept. 16	do	62·1	143·5	5·04	6·46	724·0
Oct. 13	V. A. Newhall	60·5	101·3	3·77	5·76	371·9
Nov. 29	do	55	74·0	2·88	5·62	212·1
Dec. 11	do	59	90·7	2·38	5·62	215·9

Daily Gauge Height and Discharge of Kananaskis River, near Kananaskis, Alta., for 1911.

Day.	September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	6·73	860	5·83	404	5·37	172	.....	.....
2	6·72	855	5·85	415	5·40	187	5·16	.....
3	6·74	865	5·81	394	5·38	177	5·15	.....
4	7·34	1,168	5·80	389	5·35	162	5·14	.....
5	7·10	1,047	5·76	369	5·34	157	5·15	.....
6	7·00	996	5·75	364	5·36	167	5·16	.....
7	6·88	936	5·71	344	5·38	177	5·13	.....
8	6·76	875	5·69	334	5·30	136	5·12	.....
9	6·71	850	5·70	339	5·25	111	5·10	.....
10	6·63	809	5·68	329	5·25	111	5·11	.....
11	6·61	799	5·67	324	5·25	111	.....	.....
12	6·58	784	5·66	318	.....	.....	.....	.....
13	6·54	764	5·65	313	.....	.....	.....	.....
14	6·53	759	5·66	318	.....	.....	.....	.....
15	6·48	733	5·64	308	.....	.....	.....	.....
16	6·43	708	5·63	303	.....	.....	.....	.....
17	6·36	673	5·64	308	.....	.....	5·25	.....
18	6·30	642	5·62	298	.....	.....	5·35	.....
19	6·30	642	5·61	293	.....	.....	5·35	.....
20	6·23	607	5·59	283	.....	.....	5·33	.....
21	6·15	566	5·58	278	.....	.....	5·31	.....
22	6·17	577	5·57	273	.....	.....	5·30	.....
23	6·12	551	5·56	268	.....	.....	5·29	.....
24	6·08	531	5·55	263	.....	.....	5·28	.....
25	6·05	516	5·54	258	5·24	.....	5·26	.....
26	6·01	496	5·52	248	5·27	.....	5·26	.....
27	5·99	485	5·51	243	5·28	.....	5·20	.....
28	5·98	480	5·45	212	.....	.....	5·18	.....
29	5·90	440	5·44	207	.....	.....	5·17	.....
30	5·88	430	5·43	202	.....	.....	5·15	.....
31	.....	.....	5·40	187	.....	.....	5·14	.....

Note.—Stream frozen over on Nov. 12, observer did not read the gauge from Nov. 12 to 24, Nov. 29 to Dec. 1, and Dec. 11 to 15. The gauge height readings from Nov. 25 to end of year are of little value. It was difficult to read the gauge and the observer did not cut a large enough hole. His readings do not agree with those of the hydrographer. As the observer was away from home at the time of the visit of the hydrographer it was not until after the end of the year that he was shown the correct method of making observations.

SESSIONAL PAPER No. 25e

Monthly Discharge of Kananaskis River, near Kananaskis, Alta., for 1911.

(Drainage area, 406 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
September	1,168	430	715	1·761	1·96	42,545
October	415	187	300	0·739	0·85	18,446
November (1-11)	187	111	152	0·374	0·15	3,316
The period					2·96	64,307

Discharge Measurements of Kananaskis River, near Kananaskis, in 1912.

Date.	Hydrographer.	Width.	Area of Section.	Mean Velocity.	Gauge Height	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Jan. 3	V. A. Newhall	57·0	160·1	0·98	8·34	141·15
Jan. 20	do	30·0	43·25	2·88	5·98	124·70
Feb. 1	do	60·0	70·80	2·26	6·23	160·20
Feb. 13	do	58·0	60·50	2·24	6·35	135·80
Feb. 21	do	60·0	64·50	2·19	6·52	141·15
Mar. 1	do	60·0	58·50	1·79	6·04	104·68
Mar. 12	H. C. Ritchie	60·0	69·00	1·87	6·47	128·00
Mar. 21	do	Slush ice to bottom.				
April 3	do	59·0	58·40	2·20	5·10	128·71
April 16	do	60·0	64·50	2·20	5·08	143·44
April 30	do	58·0	64·38	2·29	5·12	147·89
May 14	do	60·0	108·70	4·02	5·98	427·23
May 27	do	63·5	151·93	5·68	6·75	863·33
June 12	do	62·0	141·55	5·47	6·62	774·09
June 26	do	65·0	271·86	6·11	8·37	1,661·56
July 10	do	66·0	321·30	8·43	8·92	2,707·95
July 25	do	65·0	245·40	7·14	7·87	1,715·28
Aug. 7	do	63·5	205·35	6·39	7·10	1,312·59
Aug. 21	do	64·0	204·70	5·89	7·20	1,205·00
Sept. 6	do	65·1	144·40	5·11	6·34	738·30
Sept. 25	do	60·0	116·00	4·80	6·05	558·00
Oct. 8	do	60·0	96·80	3·77	5·60	365·00
Oct. 22	do	59·0	96·20	4·07	5·49	391·50
Nov. 5	do	58·0	84·70	3·55	5·24	301·00
Nov. 19	do	57·5	82·53	3·48	5·16	287·00
Dec. 4	do	60·0	130·00	2·30	5·94	299·14
Dec. 17	do	56·0	121·00	1·58	5·90	190·40

Daily Gauge Height and Discharge of Kananaskis River, near Kananaskis, for 1912.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	7·00	138·00	6·50	131·75	6·17	127·63	5·00	120·00	5·14	154·40	6·32	626·40
2	7·30	141·75	6·53	132·13	6·16	127·50	5·02	124·80	5·15	157·00	6·22	574·40
3	7·50	144·25	6·50	131·75	6·14	127·25	4·97	112·80	5·15	157·00	6·17	548·40
4	8·80	160·50	6·53	132·13	6·08	126·50	4·98	115·20	5·16	159·60	6·14	532·80
5	8·30	154·25	6·52	132·00	6·10	126·75	4·98	115·20	5·17	162·20	6·08	502·40
6	8·30	154·25	6·50	131·75	6·09	126·63	4·95	108·00	5·19	167·40	6·03	478·40
7	8·30	154·25	6·49	131·63	6·05	126·13	5·00	120·00	5·21	173·00	6·09	507·20
8	7·80	148·00	6·47	131·37	6·03	125·88	5·03	127·20	5·40	230·00	6·18	553·60
9	7·30	141·75	6·20	128·00	6·04	126·00	5·01	122·40	5·58	292·80	6·47	707·20
10	7·40	143·00	6·10	126·75	6·18	127·75	5·01	122·40	5·00	120·00	6·56	757·60
11	7·50	144·25	5·45	118·62	6·25	128·63	5·03	127·20	5·49	260·60	6·62	791·20
12	7·50	144·25	5·43	118·38	6·49	131·63	5·02	124·80	5·48	257·20	6·76	872·00
13	7·30	141·75	6·35	129·63	6·50	131·75	5·04	129·6	5·64	314·40	6·99	101·00
14	7·20	140·50	6·34	129·75	6·49	131·63	5·03	127·20	5·98	455·20	7·10	1,080·00
15	7·10	139·25	6·29	129·13	6·50	131·75	5·04	129·60	6·35	642·00	7·97	1,740·00
16	6·50	131·75	6·27	128·87	6·53	132·13	5·06	134·40	6·71	842·00	9·21	2,877·20
17	6·40	130·50	6·28	129·00	6·37	130·13	5·03	127·20	6·36	647·20	9·35	3,006·00
18	6·30	129·25	6·29	129·13	6·38	130·25	5·05	132·00	6·42	670·20	9·15	2,822·00
19	6·00	125·50	6·28	129·00	6·37	130·13	5·00	120·00	6·45	696·00	9·12	2,794·40
20	5·98	125·25	6·29	129·13	6·39	130·37	5·01	122·40	6·32	626·40	9·04	2,720·80
21	5·95	124·88	6·26	128·75	6·38	130·25	5·06	134·40	6·24	584·80	8·78	2,481·60
22	5·93	124·63	6·22	128·25	6·40	130·50	5·05	132·00	6·15	538·00	8·73	2,435·60
23	5·90	124·25	6·24	128·50	6·39	130·37	5·04	129·60	6·20	564·00	8·54	2,260·80
24	5·87	123·88	6·23	128·37	6·40	130·50	5·06	134·40	6·25	590·00	8·48	2,205·60
25	5·85	123·63	6·25	128·63	6·40	130·50	5·10	144·00	6·30	616·00	8·44	2,168·80
26	5·85	123·63	6·23	128·37	6·43	130·87	5·11	146·60	6·54	746·40	8·40	2,132·00
27	5·83	123·38	6·23	128·37	6·45	131·13	5·09	141·60	6·75	866·00	8·30	2,048·00
28	5·83	123·38	6·21	128·12	6·43	130·87	5·06	134·40	6·67	819·20	8·15	1,920·00
29	5·80	123·00	6·18	127·75	6·43	130·87	5·09	141·60	6·60	780·00	8·01	1,800·00
30	6·00	125·50			6·45	131·13	5·12	149·20	6·55	752·00	8·78	2,520·00
31	6·20	128·00			5·02	113·25			6·52	735·20		

SESSIONAL PAPER No. 25e

Daily Gauge Height and Discharge of Kananaskis River, near Kananaskis, for 1912.—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	7·62	*1,488	7·20	1,248	6·65	898	5·67	414	5·28	311	5·32	148
2	7·58	1,464	7·17	1,228	6·51	818	5·63	402	5·27	309	5·41	176
3	9·52	3,210	7·13	1,202	6·34	722	5·60	392	5·29	314	5·90	298
4	7·43	1,360	7·15	1,215	6·27	684	5·63	402	5·27	309	5·94	296
5	7·36	1,320	7·24	1,277	6·35	728	5·66	411	5·24	302	6·30	440
6	7·46	1,408	7·17	1,228	6·36	734	5·62	398	5·23	299	6·31	436
7	7·72	1,608	7·08	1,169	6·29	695	5·60	392	5·23	299	5·71	204
8	8·63	2,520	7·03	1,137	6·30	700	5·59	389	5·21	294	5·64	176
9	8·84	2,632	6·98	1,105	6·32	711	5·61	395	5·23	299	5·96	272
10	8·90	*2,688	6·90	1,052	6·30	709	5·57	384	5·22	297	5·49	120
11	8·89	2,680	7·05	1,150	6·32	711	5·60	392	5·20	292	5·28	72
12	8·69	2,495	7·03	1,137	6·35	728	5·62	398	5·23	299	5·30	72
13	8·70	2,504	6·92	1,065	6·40	756	5·57	384	5·21	294	5·42	88
14	9·12	2,890	6·84	1,014	6·38	745	5·56	381	5·19	290	5·64	136
15	8·82	2,614	6·87	1,033	6·33	717	5·53	372	5·16	284	†5·70	148
16	8·49	2,311	6·90	1,052	6·31	706	5·54	375	5·09	270	5·91	208
17	8·50	2,320	7·26	1,292	6·26	679	5·58	386	5·10	272	5·90	192
18	7·86	1,744	7·32	1,334	6·19	643	5·57	384	5·17	286	5·86	190
19	7·58	1,525	7·35	1,356	6·19	643	5·55	378	5·16	284	5·81	188
20	7·55	1,503	7·24	1,277	6·08	588	5·56	381	5·12	256	5·96	193
21	9·53	3,258	7·20	1,248	6·00	548	5·54	375	5·13	244	5·93	192
22	9·24	3,001	7·18	1,235	5·98	538	5·49	362	5·10	216	5·60	178
23	7·32	1,334	7·15	1,215	6·01	553	5·48	359	5·09	200	6·08	198
24	7·53	1,488	7·20	1,248	6·07	583	5·46	354	5·11	192	5·91	191
25	7·84	1,728	7·63	1,563	6·12	608	5·45	352	5·06	156	†6·00	196
26	7·78	1,680	8·00	1,863	6·03	663	5·44	350	5·05	144	6·64	216
27	7·71	1,624	9·69	3,115	5·84	476	5·42	345	5·10	144	6·30	200
28	7·54	1,496	9·48	3,222	5·77	449	5·44	350	5·08	120	6·52	208
29	7·40	1,392	9·34	3,093	5·73	435	5·44	350	5·20	136	6·75	224
30	7·31	1,327	7·12	1,195	5·70	424	5·38	335	5·30	152	6·89	232
31	7·22	1,262	6·93	1,572			5·29	314			7·10	248

* Shifting conditions July 1 to July 10.
† Gauge heights interpolated.

Monthly Discharge of Kananaskis River, near Kananaskis, for 1912.

(Drainage area, 466 square miles.)

Month.	Discharge in Second-Feet				Run-Off.	
	Maximum.	Minimum.	Mean.	Per Square Mile.	Depth in inches on Drainage Area.	Total in Acre-feet.
January	160	123	136	0·33	0·38	8,332
February	132	118	129	0·32	0·34	7,109
March	132	113	129	0·32	0·37	7,926
April	149	108	128	0·32	0·36	7,635
May	866	120	177	1·17	1·35	29,305
June	3,006	478	1,582	3·90	4·35	94,138
July	3,258	1,262	1,996	4·91	5·66	122,729
August	3,222	1,044	1,424	3·51	4·05	87,558
September	898	424	653	1·61	1·80	38,856
October	414	314	376	0·926	1·07	23,119
November	311	120	252	0·621	0·69	14,995
December	440	72	204	0·502	0·58	12,543
The year					21·00	454,545

Discharge Measurements of Bow River, near Morley, in 1910.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 26	J. C. Keith	222·7	1,466·59	6·44	4·90	9,443·54
June 21	do	235·7	1,610·50	7·49	5·55	12,066·97
July 14	do	217·7	1,422·58	5·96	4·74	8,476·01
Aug. 9	do	207·4	1,207·23	4·96	3·80	5,990·30
Aug. 30	do	182·2	933·94	3·26	2·37	3,047·86
*Sept. 21	do	182·2	926·86	3·22	2·38	2,987·93
†Sept. 21	do	182·2	926·86	3·23	2·38	2,989·38
Oct. 17	H. R. Carscallen	179·5	903·80	3·06	2·30	2,767·68
Nov. 4	do	175·5	799·30	2·29	1·63	1,829·87
Nov. 30	do	155·5	733·35	1·61	1·22	1,177·06
Dec. 22	do	154·0	463·81	1·83	1·16	847·19

* One point method used.
† Two point method used.

Daily Gauge Height and Discharge of Bow River, near Morley, for 1910

Day.	May.		June.		July.		August.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			4·15	6·910	4·85	9,255	3·45	5,185
2			4·4	7,660	4·9	9,440	3·4	5,070
3			4·25	7,195	4·6	8,350	3·3	4,850
4			4·05	6,635	4·55	8,175	3·25	4,740
5			3·85	6,115	4·5	8,000	3·55	5,415
6			4·0	6,500	4·5	8,000	4·0	6,500
7			4·45	7,830	4·45	7,830	4·05	6,635
8			4·55	8,175	4·5	8,000	4·0	6,500
9			4·4	7,660	4·55	8,175	3·85	6,115
10			4·4	7,660	4·45	7,830	3·85	6,115
11			4·8	9,070	4·45	7,830	3·75	5,875
12			5·65	12,475	4·55	8,175	3·75	5,875
13			5·7	12,680	4·7	8,700	3·7	5,760
14			5·2	10,640	4·85	9,255	3·65	5,645
15			5·05	10,040	4·85	9,255	3·6	5,530
16			5·35	11,245	4·95	9,640	3·5	5,300
17			5·5	11,860	4·8	9,070	3·35	4,960
18			5·8	13,090	4·9	9,440	3·25	4,740
19			5·35	11,245	4·75	8,885	3·2	4,630
20			5·35	11,245	4·55	8,175	3·1	4,410
21			5·7	12,680	4·45	7,830	3·1	4,410
22			5·4	11,450	4·4	7,660	3·05	4,305
23			5·0	9,840	4·3	7,340	3·0	4,200
24			4·65	8,525	4·2	7,050	2·95	4,095
25	4·6	8,350	4·45	7,830	3·9	6,240	2·75	3,685
26	5·1	10,240	4·7	8,700	3·95	6,370	2·65	3,485
27	5·15	10,440	5·0	9,840	3·8	5,990	2·55	3,305
28	4·8	9,070	5·25	10,840	3·7	5,760	2·55	3,305
29	4·4	7,660	5·25	10,840	3·8	5,990	2·45	3,115
30	4·2	7,050	5·0	9,840	3·77	5,921	2·38	2,986
31	4·0	6,500			3·8	5,990	2·36	2,952

Daily Gauge Height and Discharge of Bow River, near Morley, for 1910.—*Continued.*

Day.	September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·33	2,901	2·1	2,520	1·67	1,888	1·2	*1,150
2	2·28	2,816	2·08	2,490	1·7	1,930	1·4	*1,380
3	2·18	2,648	2·0	2,370	1·65	1,860	1·38	*1,340
4	2·27	2,799	2·0	2,370	1·7	1,930	1·28	*1,210
5	2·35	2,935	1·95	2,295	1·64	1,846	1·47	*1,430
6	2·45	3,115	1·9	2,220	1·66	1,874	1·49	*1,440
7	2·5	3,210	2·0	2,370	1·6	1,790	1·55	*1,510
8	2·43	3,077	2·1	2,520	1·5	1,660	1·46	*1,380
9	2·25	2,765	2·05	2,445	1·53	1,699	1·45	*1,350
10	2·2	2,680	2·2	2,680	1·55	1,725	1·53	*1,440
11	2·23	2,731	2·3	2,850	1·52	1,686	1·5	*1,400
12	2·13	2,568	2·35	2,935	1·53	1,699	1·25	*1,080
13	2·12	2,552	2·25	2,765	1·45	1,595	1·45	*1,300
14	2·07	2,475	2·27	2,799	1·5	1,660	1·4	*1,220
15	2·07	2,475	2·15	2,690	1·45	*1,595	1·25	*1,030
16	2·1	2,520	2·15	2,690	1·4	*1,530	1·23	*1,000
17	2·23	2,731	2·3	2,850	1·34	*1,440	1·27	*1,020
18	2·25	2,765	2·38	2,986	1·25	*1,320	1·3	*1,050
19	2·3	2,850	2·32	2,884	1·37	*1,470	1·2	* 920
20	2·35	2,935	2·24	2,748	1·37	*1,460	1·2	* 920
21	2·33	2,901	2·2	2,680	1·36	*1,440	1·19	* 890
22	2·4	3,020	2·15	2,690	1·33	*1,390	1·15	* 840
23	2·44	3,096	2·1	2,520	1·34	*1,400	1·25	* 870
24	2·33	2,901	2·04	2,430	1·45	*1,520	1·25	* 800
25	2·4	3,020	2·05	2,445	1·0	* 970	1·3	* 770
26	2·37	2,969	2·0	2,370	1·0	* 960	1·47	* 900
27	2·25	2,765	1·93	2,265	1·0	* 950	1·6	* 990
28	2·15	2,600	1·86	2,160	1·03	* 980	1·55	* 860
29	2·11	2,536	1·8	2,070	1·15	*1,100	1·7	* 970
30	2·06	2,460	1·75	2,000	1·23	*1,190	2·35	* 980
31			1·73	1,972			2·25	* 990

* Changing conditions due to ice: Nov. 15th to Dec. 31st.

Monthly Discharge of Bow River, near Morley, for 1910.

Drainage area, 2,099 square miles.

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May (25-31)	10,440	6,500	8,472·8	4·03	1·04	117,639
June	13,090	6,115	9,543·8	4·54	5·06	567,894
July	9,640	5,760	7,858·7	3·74	4·31	483,211
August	6,635	2,952	4,828·8	2·30	2·65	297,916
September	3,210	2,460	2,793·8	1·33	1·48	166,244
October	2,986	1,972	2,509·9	1·20	1·38	154,324
November	1,930	930	1,518·6	·72	·80	90,366
December	1,510	770	1,110·6	·53	·61	68,287
The period						1,945,881

Discharge Measurements of Bow River near Morley, Alta., in 1911.

Date.	Hydrographer.	Width	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Jan. 21	H. R. Carscallen	143	328.1	2.06	2.83	675.0†
Feb. 10	do	89	302.5	2.22	2.95	671.3†
Mar. 3	do	114	369.5	1.66	2.85	613.5x
Mar. 21	do	114	412.0	1.77	2.53	730.6x
Apr. 5	H. C. Ritchie	107	406.6	1.80	0.80	733.2?
Apr. 25	H. C. Ritchie	162.5	668.1	1.41	0.89	941.6
May 9	do	179	866.3	2.53	1.85	2,190
May 30	B. Russell	196.5	865.9	2.74	2.04	2,377
June 14	do	241.2	1,748	7.07	6.08	12,375
July 12	do	217.5	1,350	5.71	4.42	7,702
Aug. 14	H. Brown	198.4	1,200	4.91	3 69	5,930
Sept. 23	do	198	932 1	2.95	2.26	2,746
Oct. 12	V. A. Newhall	174.4	804.3	2.26	1.73	1,821
Nov. 17	do	174.6	915.5	1.50	3.50	1,374 *
Nov. 27	do	177.6	952.8	0.85	3.24	807.2*
Dec. 14	do	187.6	841.8	1 30	2.74	1.091**

† Stream frozen over, conditions bad, results approximate.
x Stream frozen over.
? Stream partly frozen over, results may be slightly inaccurate.
|| May be slight error due to inaccuracy of soundings.
* Large amount of slush ice, results only approximate.
**Large amount of slush ice. Compared with the records at Banff and Calgary the discharge appears to be too high.

Daily Gauge Height and Discharge of Bow River near Morley, Alta., for 1911.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·85	....	2·75	590	2·85	614	0·74	694	1·20	1,240	3·35	5,040
2	2·30	....	2·75	586	2·85	614	0·70	670	1·27	1,317	4·40	7,700
3	†2·40	....	2·80	610	2·83	604	0·70	670	1·36	1,422	4·80	8,740
4	†2·45	....	2·75	582	2·75	564	0·70	670	1·40	1,470	4·90	9,000
5	†2·50	....	2·85	630	2·80	588	0·76	708	1·60	1,720	†4·62	8,272
6	2·60	....	2·85	626	2·75	564	0·88	808	1·90	2,160	4·35	7,570
7	†2·60	....	2·90	652	2·85	614	0·65	674	1·80	2,010	4·05	6,790
8	2·60	....	2·85	620	2·80	588	0·68	708	1·80	2,010	3·95	6,530
9	2·15	....	2·90	646	2·80	588	0·75	768	1·82	2,040	3·85	6,275
10	1·95	....	2·90	642	2·70	564	0·72	768,	1·80	2,010	3·90	6,400
11	2·15	....	2·95	672	2·65	562	0·70	774	1·75	1,935	4·40	7,700
12	2·25	....	3·00	704	2·60	560	0·65	755	1·80	2,010	5·15	9,690
13	2·45	....	2·95	672	2·60	580	*0·35	340	1·85	2,085	5·80	11,550
14	2·50	....	2·90	642	2·55	576	0·65	755	1·80	2,010	6·10	12,460
15	2·70	....	2·85	614	2·65	652	0·70	790	1·75	1,935	6·20	12,770
16	2·75	....	2·75	564	2·60	648	0·68	776	1·95	2,240	6·15	12,615
17	2·95	....	2·80	588	2·60	672	0·70	790	2·10	2,480	6·10	12,460
18	2·95	....	2·85	614	2·63	720	0·74	822	2·20	2,640	6·05	12,305
19	2·80	....	2·80	588	2·60	724	0·70	790	2·18	2,608	6·00	12,150
20	2·85	....	2·80	588	2·56	726	0·75	830	2·25	2,725	5·75	11,405
21	2·80	654	2·75	564	2·55	746	0·80	870	2·27	2,759	5·65	11,115
22	2·85	680	2·85	614	2·50	790	*0·35	340	2·26	2,742	5·75	11,405
23	2·80	646	2·85	614	2·47	856	0·90	950	2·37	2,943	6·20	12,770
24	2·70	590	2·83	604	2·30	814	1·22	1,262	2·27	2,759	6·35	13,235
25	2·70	586	2·85	614	2·25	862	0·98	1,022	2·17	2,592	6·45	13,545
26	2·60	536	2·80	588	2·15	878	†1·06	1,100	2·10	2,480	6·05	12,305
27	2·55	512	2·85	614	2·07	904	1·15	1,190	2·05	2,400	5·65	11,115
28	2·65	554	2·80	588	1·05	920	1·10	1,140	1·95	2,240	5·60	10,970
29	2·75	598	..	..	0·85	766	1·17	1,210	1·98	2,288	5·55	10,825
30	2·70	570	..	..	0·80	732	1·12	1,160	2·06	2,416	5·55	10,825
31	2·75	592		..	0·76	708	.	....	2·60	3,400	....	....

Daily Gauge Height and Discharge of Bow River near Morley, Alta., for 1911.—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	5·50	10,680	3·86	6,300	†3·05	4,345	1·95	2,240	1·48	1,566	3·30	....
2	5·55	10,825	†3·90	6,400	3·10	4,460	1·97	2,272	†1·48	1,566	3·26	..
3	5·40	10,390	3·95	6,530	3·15	4,575	1·95	2,240	†1·48	1,566	3·31	.. .
4	5·20	9,830	4·00	6,660	3·40	5,160	1·90	2,160	1·48	1,566	3·19	.. .
5	†4·95	9,135	4·05	6,790	3·30	4,920	1·85	2,085	1·35	1,410	3·26	.
6	4·70	8,480	4·15	7,050	†3·21	4,713	1·80	2,010	1·61	1,734	3·14	..
7	4·90	9,000	4·25	7,310	3·12	4,506	1·70	1,860	1·45	1,530	3·03	
8	5·00	9,270	4·30	7,440	3·00	4,230	1·78	1,980	1·53	1,629	3·10	
9	4·75	8,610	4·15	7,050	2·95	4,120	1·70	1,860	..	....	3·31	
10	4·55	8,090	4·03	6,738	3·20	4,690	1·56	1,668	..	...	3·03	
11	4·40	7,700	†3·91	6,426	2·75	3,700	1·65	1,790	..	..	2·82	..
12	4·40	7,700	3·80	6,150	2·75	3,700	1·70	1,860	1·73	..	2·85	
13	4·25	7,310	3·70	5,900	2·70	3,600	†1·70	1,860	3·05	..	2·75	
14	4·30	7,440	3·65	5,775	2·70	3,600	1·70	1,860	3·03		2·74	
15	4·35	7,570	3·60	5,650	2·65	3,500	1·69	1,846	3·24		2·73	
16	4·55	8,090	3·60	5,650	2·60	3,400	1·77	1,965	3·28		2·74	
17	4·80	8,740	†3·54	5,500	2·55	3,300	1·69	1,846	3·25		2·68	
18	4·70	8,480	†3·47	5,328	2·50	3,200	1·68	1,832	†3·56		2·27	
19	†4·47	7,882	3·40	5,160	2·45	3,100	1·66	1,804	3·88		2·32	
20	4·25	7,310	3·43	5,232	2·35	2,905	1·59	1,707	3·98	..	2·74	
21	4·18	7,128	3·45	5,280	2·30	2,810	1·69	1,846	3·99		2·69	
22	4·22	7,232	3·40	5,160	2·30	2,810	1·68	1,832	3·96		2·63	
23	4·25	7,310	3·35	5,040	2·27	2,759	1·71	1,875	4·02		2·73	
24	4·15	7,050	†3·27	4,851	2·18	2,608	†1·70	1,860	†3·83		2·76	
25	4·15	7,050	3·20	4,693	2·15	2,560	1·69	1,846	†3·63		2·62	
26	4·35	7,570	†3·50	5,400	2·10	2,480	1·59	1,707	†3·44		2·69	
27	4·30	7,440	3·80	6,150	2·05	2,400	1·48	1,566	3·24	807	2·74	
28	4·15	7,050	3·05	4,345	2·00	2,320	†1·42	1,494	3·07	724	2·72	
29	4·05	6,790	3·03	4,299	2·00	2,320	†1·36	1,422	3·13	800	2·69	
30	3·95	6,530	2·93	4,076	1·95	2,240	1·30	1,350	3·07	798	2·68	
31	3·80	6,150	†2·99	4,208			1·39	1,458	..		2·74	

During January, February, March and November. Daily discharge for these months are only approximate.
†No observation, gauge height interpolated.
*Negative gauge height. Low water caused by Calgary Power and Transmission Co. holding back the water.
Note—Data insufficient to compute the daily discharge from Jan. 1 to 20, Nov. 9 to 26 and Dec. 1 to 31. Ice conditions

Monthly Discharge of Bow River near Morley, Alta., for 1911.

Drainage area, 2,111 square miles.

Month.	Discharge in Second-Feet				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January (21-31)	680	512	593	0·281	0·11	12,938
February	704	564	615	0·291	0·30	34,155
March	920	560	687	0·325	0·37	42,242
April	1,262	340	827	0·392	0·44	49,210
May	3,400	1,240	2,229	1·06	1·22	137,058
June	13,545	5,040	10,184	4·82	5·38	605,990
July	10,825	6,150	8,059	3·82	4·40	495,529
August	7,440	4,076	5,759	2·73	3·15	354,108
September	5,163	2,240	3,501	1·66	1·85	208,324
October	2,272	1,350	1,840	0·872	1·00	113,140
November (1-8 27-30)	1,734	724	1,308	0·620	0·28	31,133
The period	....	....	....	....	18·50	2,083,827

Discharge Measurements of Bow River near Kananaskis, in 1912.

Date.	Hydrographer.	Width.	Area of section.	Mean Velocity.	Gauge Height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
*Feb. 29	V. A. Newhall	270·00	302·25	1·94	.....	587·18
*Mar. 10	H. C. Ritchie	255·00	267·00	2·174	2·00	580·45
*Mar. 20	do	272·00	244·55	2·27	1·97	555·30
*April 2	do	338·00	271·25	2·09	1·84	567·99
April 15	do	346·50	287·90	2·14	1·83	617·22
April 29	do	349·00	300·50	2·27	1·85	681·88
May 13	do	367·00	423·70	3·25	2·23	1,388·39
May 28	do	403·00	783·55	5·78	3·03	4,528·61
June 11	do	402·00	731·00	5·51	2·94	4,027·07
June 25	do	422·00	1,042·98	7·35	3·70	7,672·14
July 9	do	416·00	1,033·85	7·34	3·70	7,591·62
July 25	do	412·00	986·40	6·47	3·60	6,403·36
Aug. 6	do	406·5	827·48	6·21	3·20	5,139·39
Aug. 20	do	409·00	980·20	6·61	3·60	6,477·10
Sept. 6	do	399·00	698·60	5·41	2·87	3,780·00
Sept. 24	H. R. Cram	397·00	606·00	4·59	2·54	2,784·00
Oct. 9	do	381·00	556·00	3·97	2·50	2,207·00
Oct. 23	H. C. Ritchie	372·00	488·00	3·41	2·40	1,662·00
Nov. 6	do	359·00	412·00	3·51	2·22	1,448·00
*Nov. 19	do	373·00	422·7	3·23	2·23	1,366·70
*Dec. 3	do	319·00	500·00	2·82	3·16	1,212·40
*Dec. 17	do	180·00	555·4	1·57	4·32	871·00

*Ice conditions.
Note.—This station established in 1912 to replace the station at Morley.

Daily Gauge Height and Discharge of Bow River, near Kananaskis, for 1912.

Day.	March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	1·98	578	1·87	665	2·53	2,428
2	.....	.....	1·97	577	1·85	635	2·51	2,356
3	.....	.....	1·86	650	1·88	680	2·50	2,320
4	.....	.....	1·87	665	1·87	695	2·47	2,221
5	.....	.....	1·86	650	1·88	680	2·45	2,155
6	.....	.....	1·85	635	1·87	665	2·41	2,023
7	.....	.....	1·83	605	1·89	695	2·37	1,894
8	.....	.....	1·85	635	1·93	764	2·52	2,392
9	.....	.....	1·85	635	2·09	1,097	2·71	3,100
10	2·00	580	1·88	680	2·08	1,074	2·96	4,100
11	1·99	579	1·90	710	2·10	1,120	2·98	4,180
12	1·98	578	1·88	680	2·15	1,255	3·04	4,432
13	1·92	572	1·89	695	2·23	1,474	3·06	4,518
14	1·85	575	1·86	650	2·36	1,862	3·57	6,927
15	1·78	586	1·87	665	2·54	2,464	3·61	7,131
16	1·97	577	1·88	680	2·86	3,700	3·74	7,794
17	1·95	575	1·80	560	2·89	3,820	3·80	8,100
18	1·96	576	1·82	590	2·86	3,700	3·74	7,794
19	1·99	579	1·79	546	2·85	3,660	3·75	7,845
20	1·97	577	1·83	605	2·63	2,794	3·73	7,743
21	1·97	577	1·82	590	2·50	2,320	3·76	7,896
22	1·94	574	1·83	605	2·49	2,287	3·72	7,692
23	1·95	575	1·84	620	2·46	2,188	3·63	7,233
24	1·92	572	1·83	605	2·43	2,089	3·64	7,284
25	1·90	570	1·80	560	2·61	2,718	3·70	7,590
26	1·89	571	1·84	620	2·79	3,420	3·66	7,386
27	1·88	572	1·85	635	2·88	3,780	3·62	7,182
28	1·87	573	1·84	620	3·03	4,389	3·64	7,284
29	2·20	640	1·85	635	3·00	4,260	3·65	7,335
30	2·10	600	1·85	635	2·98	4,180	3·37	5,919
31	2·10	600	.....	.....	2·70	3,060	.....	.....

Daily Gauge Height and Discharge of Bow River, near Kananaskis, for 1912.—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	3·26	5,410	3·18	5,050	3·08	4,604	2·54	2,464	2·39	1,958	3·34	710
2	3·17	5,005	3·21	5,185	3·01	4,303	2·52	2,392	2·47	2,221	3·32	746
3	3·09	4,647	3·19	5,095	2·97	4,140	2·50	2,320	2·40	1,991	3·39	890
4	3·06	4,518	3·22	5,230	2·95	4,060	2·49	2,287	2·33	1,766	3·33	854
5	3·04	4,432	3·25	5,365	2·99	4,220	2·53	2·428	2·27	1,586	3·26	800
6	3·05	4,475	3·20	5,140	2·89	3,820	2·50	2,320	2·21	1,418	3·04	635
7	3·42	6,162	3·16	4,960	2·80	3,460	2·52	2,392	2·19	1,363	2·93	490
8	3·56	6,876	3·11	4,735	2·80	3,460	2·53	2,428	2·18	1,336	2·74	420
9	3·70	7,590	3·07	4,561	2·79	3,420	2·52	2,392	2·15	1,255	2·47	360
10	3·72	7,692	3·15	4,915	2·81	3,500	2·49	2,287	2·16	1,282	2·49	300
11	3·69	7,539	3·09	4,647	3·06	4,518	2·47	2,221	2·15	1,255	2·97	324
12	3·67	7,437	3·05	4,475	3·07	4,561	2·45	2,155	2·16	1,282	3·51	360
13	3·74	7,794	3·00	4,260	3·04	4,432	2·44	2,122	2·18	1,336	3·53	420
14	3·84	8,308	2·96	4,100	2·74	3,220	2·45	2,155	2·15	1,255	3·32	300
15	3·66	7,386	2·97	4,140	2·71	3,100	2·43	2,089	2·10	1,120	3·70	360
16	3·62	7,182	2·99	4,220	2·73	3,180	2·44	2,122	1·99	872	4·16	420
17	3·54	6,774	3·27	5,455	2·69	3,022	2·18	2,254	2·48	*1,390	4·32	710
18	3·43	6,213	3·52	6,72	2·672	2,946	2·46	2,188	2·31	1,228	5·00	890
19	3·48	6,468	3·61	7,131	2·63	2,794	2·47	2,221	2·24	1,255	5·68	1,120
20	3·37	5,919	3·60	7,080	2·60	2,680	2·45	2,155	2·22	1,250	6·33	1,390
21	3·31	5,637	3·67	7,437	2·58	2,608	2·43	2,089	2·19	1,174	6·06	1,120
22	3·06	4,518	3·63	7,233	2·56	2,536	2·42	2,056	2·15	1,120	6·10	1,120
23	3·12	4,780	3·60	7,080	2·53	2,428	2·45	2,155	2·12	872	5·72	890
24	3·37	5,919	3·69	7,539	2·58	2,608	2·43	2,089	2·14	1,170	5·60	710
25	3·64	7,284	3·77	7,947	2·69	2,680	2·32	1,734	2·32	1,070	5·37	560
26	3·72	7,692	3·71	7,641	2·57	2,572	2·39	1,958	2·35	800	5·37	560
27	3·37	5,919	3·73	7,743	2·59	2,644	2·39	1,958	2·94	854	4·94	560
28	3·25	5,365	3·70	7,590	2·57	2,572	2·35	1,830	2·95	836	4·56	590
29	3·18	5,050	3·69	7,539	2·53	2,428	2·32	1,734	3·04	710	4·63	560
30	3·19	5,095	3·65	7,335	2·50	2,320	2·38	1,926	2·98	746	4·42	632
31	3·16	4,960	3·41	6,111			2·40	1,990			4·44	532

*Ice conditions.

Monthly Discharge of Bow River near Kananaskis, for 1912.

(Drainage area, 1304 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per Square Mile.	Depth in inches on Drainage Area.	Total in Acre-feet.
March (10-31)	640	570	580·50	0·45	0·37	34,542
April	710	546	627·00	0·48	0·54	37,321
May	4,389	635	2,199·68	1·69	1·95	135,240
June	8,100	1,891	5,475·13	4·20	4·48	325,753
July	8,308	4,432	6,130·0	4·70	5·42	376,920
August	7,947	4,100	5,923·0	4·54	5·23	364,193
September	4,604	2,320	3,294·0	2·53	2·82	196,006
October	2,464	1,734	2,158	1·65	1·90	132,688
November	2,221	710	1,259	0·966	1·08	74,920
December	1,390	300	656	0·503	0·58	40,336
The period					24·37	1,717,919

Discharge Measurements of Ghost River at Gillies' Ranch, Alta., in 1911.

Date.	Hydrographer.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 3	H. C. Ritchie	58·0	81·2	1·60	....	130·0
June 9	R. T. Sailman	67·0	155·5	1·97	....	305·9
July 13	L. R. Brereton	89·0	164·4	2·79	....	457·9
Aug. 18	do	91·0	193·1	3·97	2·46	768·0
Sept. 19	do	70·0	143·4	2·80	1·95	401·1
Oct. 20	do	68·0	124·4	2·46	1·72	305·6
Nov. 9	V. A. Newhall	52·5	68·5	2·92	1·30	200·0
Nov. 28	do	48·0	75·3	2·94	*	221·6†
Dec. 15	do	51·0	71·6	2·68	*	192·1†

*No gauge.
†Gauging made near the site of gauge. Ice conditions but the probable error small.

Daily Gauge Height and Discharge of Ghost River at Gillies' Ranch, Alta., for 1911.

Day.	August.		September.		October.		November.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	.....	2·11	498	1·85	355	1·44	228
2	.....	.....	2·06	465	1·86	359	1·44	228
3	.....	.....	2·43	740	1·86	359	1·49	240
4	.....	.....	3·03	1235	1·85	355	1·52	247
5	.....	.....	2·60	879	1·84	351	1·45	230
6	.....	.....	2·55	838	1·77	324	1·44	228
7	.....	.....	2·31	644	1·77	324	1·45	230
8	.....	.....	2·26	606	1·80	335	1·34	207
9	.....	.....	2·16	532	1·80	335	1·25	191
10	.....	.....	2·15	525	1·80	335	1·25	191
11	.....	.....	2·13	511	1·80	335	1·25	191
12	.....	.....	2·07	472	1·78	328	.....	.....
13	.....	.....	2·06	465	1·70	300	.....	.....
14	.....	.....	2·00	429	1·69	297	1·55	.....
15	.....	.....	1·99	423	1·69	297	1·55	.....
16	.....	.....	2·00	429	1·67	290	1·45	.....
17	2·56	846	2·00	429	1·60	269	1·47	.....
18	2·44	748	1·95	401	1·57	261	1·66	.....
19	2·44	748	1·95	401	1·55	255	1·66	.....
20	2·56	846	1·93	391	1·56	258	1·62	.....
21	2,46	764	1,93	391	1,56	258	.....	.....
22	2·67	936	1·94	396	1·56	258	.....	.....
23	2·52	813	1·90	377	1·56	258	.....	.....
24	2·33	659	1·89	373	1·56	258	.....	.....
25	2·89	1118	1·90	377	1·56	258	.....	.....
26	2·67	936	1·94	396	1·56	258	.....	.....
27	2·45	756	1·96	407	1·45	230	.....	.....
28	2·37	691	1·93	391	1·44	228	.....	.....
29	2·31	644	1·89	373	1·44	228	.....	.....
30	2·20	561	1·86	359	1·44	228	.....	.....
31	2·16	532	.....	.....	1·45	230	.....	.....

Note.—On Nov. 12, the river was frozen to the bottom of the gauge and the height of water could not be read. A thaw on Nov. 14 caused the water to overflow the ice and on Nov. 20 the gauge was carried out by the ice which broke up. Satisfactory arrangements regarding remuneration could not be made and no observations were therefore reported after Nov. 21. Not sufficient data to compute daily discharge from Nov. 14 to 20.

SESSIONAL PAPER No. 25e

Monthly Discharge of Ghost River at Gillies' Ranch, Alta., for 1911.

(Drainage area, 367 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
August (17-31)	1,118	532	773	2·106	1·18	22,998
September	1,235	359	505	1·376	1·54	30,050
October	359	228	291	0·793	0·91	17,893
November (1-11)	247	191	219	0·597	0·24	4,778
The period					3·87	75,719

Discharge Measurements of Ghost River at Gillies' Ranch, in 1912.

Date	Hydrographer.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Feb. 2	V. A. Newhall	31·0	50·20	2·64	2·00	132·60*
Feb. 12	do	27·0	39·40	2·62	1·53	103·27
Feb. 22	do	29·0	45·25	2·10	1·80	95·01
Mar. 2	do	26·0	38·80	1·82	1·36	70·75
Mar. 13	H. C. Ritchie	39·0	38·00	2·88	1·06	109·60
Mar. 23	do	25·0	43·00	2·44	1·76	104·90*
April 17	do	47·0	58·10	2·61	0·99	152·02
May 16	do	68·0	145·00	2·35	1·51	340·64
June 14	do	63·0	113·05	1·24	1·00	140·15
June 27	do	62·5	116·57	1·79	1·02	207·91
July 11	do	93·5	246·4	5·41	4·00	1,332·7
July 26	do	86·0	269·8	5·42	4·10	1,460·4
Aug. 8	do	81·5	156·5	4·06	3·05	634·4
Aug. 22	do	81·0	183·1	3·44	3·15	630·0
Sept. 4	do	79·0	184·0	3·24	3·12	598·0
Sept. 26	H. R. Cram	78·5	155·0	3·01	2·87	466·0
Oct. 11	do	77·0	146·0	2·85	2·70	417·0
Oct. 24	H. C. Ritchie	73·0	130·0	2·48	2·41	322·0
Nov. 8	do	69·0	121·2	2·27	2·35	276·0
Nov. 21	do	70·0	114·5	2·26	2·30	258·4
Dec. 5	do	50·9	75·2	2·57	2·22	193·3*
Dec. 19	do	50·3	80·4	2·18	2·30	176·0†

*Ice conditions, Feb. 2 to Mar. 23.
† do Dec. 5 to Dec. 31.

Daily Gauge Height and Discharge of Ghost River at Gillies' Ranch, for 1912.

Day.	January.		February.		March.		April.		May		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	3·85	142·00*	1·61	97·20	2·02	105·40	3·22	129·40	1·55	362·50	1·04	153·40
2	3·85	142·00†	1·56	96·40	1·12	104·80	3·06	126·20	1·40	301·00	1·04	153·40
3	3·85	142·00	1·56	96·40	1·61	97·20	3·01	125·20	1·03	149·30	0·95	116·50
4	3·85	142·00	1·56	96·40	1·52	95·80	2·81	121·20	1·40	301·00	1·30	260·00
5	3·85	142·00†	1·54	96·10	1·61	97·20	2·56	116·20	2·00	547·00	0·95	116·50
6	3·56	136·20	2·11	107·20	3·41	**98·00	1·56	96·40	1·95	526·50	0·94	112·40
7	3·81	141·20	1·89	102·80	1·21	99·70	1·86	102·20	2·39	706·90	0·93	108·30
8	3·90	143·20	1·61	97·20	2·56	116·20	1·90	103·00	2·49	747·90	0·90	96·00
9	3·87	142·40	1·59	96·85	3·51	135·20	2·16	108·20	2·30	670·00	1·30	260·00
10	3·91	143·20	1·58	96·70	2·76	120·20	1·56	96·40	1·69	419·90	0·93	108·30
11	3·96	144·20	1·59	96·85	2·77	120·40	1·46	95·70	1·35	280·50	0·92	104·20
12	3·86	142·20	1·56	96·40	2·90	123·00	1·51	95·65*	1·40	301·00	0·90	96·00
13	3·94	143·8	1·61	97·20	0·90	124·00	1·20	120·00†	1·45	321·50	1·02	145·20
14	3·95	144·00	1·58	96·70	0·86	126·20	1·10	150·00‡	1·54	358·40	1·00	137·00
15	3·62	137·40	1·56	96·40	3·11	127·20	1·10	178·00	1·66	407·60	2·80	875·00
16	3·44	133·80	1·56	96·40	2·76	120·20	1·05	157·50†	1·60	383·00	3·30	1080·00
17	3·25	130·00	1·86	102·20	1·36	96·40	1·00	137·00	1·65	403·50	4·01	1371·10
18	2·95	124·00	1·43	95·85	1·41	95·95	1·00	137·00	1·50	342·00	2·85	895·50
19	3·09	126·80	1·60	97·00	0·89	124·90	0·95	116·50	1·59	378·90	1·80	465·00
20	3·15	128·00	1·11	105·40	0·91	123·10	0·89	91·50	1·52	350·20	1·96	530·60
21	3·05	126·00	2·03	105·60	2·76	120·20	0·86	79·60	1·80	465·00	1·45	321·50
22	2·70	119·00	1·72	99·40	2·51	115·20	0·85	75·50	1·35	280·50	1·02	145·20
23	2·36	112·20	1·11	105·40	1·44	95·80	0·95	116·50	1·20	219·00	1·01	141·10
24	2·25	110·00	1·81	101·20	2·42	113·40	0·99	132·90	1·50	342·00	1·02	145·20
25	2·15	108·00	1·71	99·20	3·06	126·20	1·05	157·50	1·40	301·00	1·02	145·20
26	1·95	104·00	1·12	104·80	2·36	112·20	1·05	157·50	1·25	239·50	1·02	145·20
27	1·90	103·00	1·51	95·65	2·54	115·80	1·03	149·30	1·30	260·00	1·01	141·10
28	1·80	101·00	1·61	97·20	3·46	134·20	1·00	137·00	1·35	280·50	1·01	141·10
29	1·74	99·80	1·01	112·10	3·61	137·20	1·00	137·00	1·10	178·00	1·20	219·00
30	1·76	100·20	.....	.....	3·16	128·20	·50	342·00	1·00	137·00	1·30	260·00
31	1·75	100·00	.....	.....	3·21	129·20	.....	.....	0·99	132·90	.....	.....

*Ice conditions Jan. 1 to Apr. 12.
†Gauge heights interpolated Jan. 1 to 5 and Apr. 13 to 16.
‡Shifting conditions Apr. 13 and 14.
**Gauge height raised by ice jam.

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Daily Gauge Height and Discharge of Ghost River at Gillies' Ranch, for 1912.—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height	Discharge	Gauge Height	Discharge.	Gauge Height.	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·35	690	2·45	732	2·15	609	1·85	486	1·39	297	1·40	276
2	1·20	219	2·40	711	2·10	588	1·84	482	1·44	317	1·45	294
3	1·80	465	2·30	670	2·10	588	1·80	465	1·49	338	1·50	312
4	2·80	875	2·30	670	2·08	580	1·75	445	1·39	297	1·35	248
5	2·85	895	2·25	650	2·14	604	1·74	441	1·40	301	1·22	194
6	3·80	1,285	2·20	629	2·15	608	1·65	404	1·38	293	1·25	186
7	4·20	1,449	2·15	609	2·08	580	1·70	424	1·34	276	1·22	186
8	4·80	1,695	2·05	568	2·28	662	1·75	445	1·34	276	1·22	186
9	4·60	1,613	2·05	568	2·30	670	1·74	441	1·39	297	1·22	186
10	4·20	1,449	2·00	547	2·14	604	1·74	441	1·40	301	1·22	186
11	4·00	1,367	2·02	555	2·10	588	1·73	436	1·45	322	1·21	186
12	3·80	1,285	2·05	568	2·05	568	1·70	424	1·45	322	1·20	186
13	3·80	1,285	1·05	527	2·04	564	1·70	424	1·40	301	1·21	186
14	3·75	1,264	1·90	506	2·00	547	1·70	424	1·39	297	1·20	186
15	3·70	1,244	1·88	498	1·95	527	1·70	424	1·30	260	1·20	186
16	3·50	1,162	1·88	498	1·95	527	1·66	408	1·34	276	1·19	186
17	3·50	1,162	3·35	1,101	1·94	522	1·68	416	1·40	301	1·12	180
18	3·25	1,060	2·95	527	1·90	506	1·66	408	1·39	297	1·10	170
19	3·30	1,080	2·35	691	1·88	498	1·65	404	1·40	301	1·30	184
20	3·00	957	2·60	793	1·84	481	1·65	404	1·35	281	1·35	184
21	3·00	957	2·20	629	1·84	481	1·50	342	1·32	268	1·38	184
22	3·00	957	2·20	629	1·95	527	1·55	362	1·30	256	1·49	182
23	3·15	1,019	2·00	547	1·95	527	1·56	367	1·30	252	1·58	180
24	3·00	1,367	2·15	609	1·90	506	1·46	326	1·30	250	1·47	182
25	4·50	1,572	3·00	957	1·90	506	1·54	358	1·20	208	1·58	180
26	3·00	957	2·50	752	1·86	490	1·50	342	1·14	180	1·60	178
27	2·95	937	2·33	682	1·85	486	1·44	317	1·25	228	1·55	181
28	2·70	834	2·50	752	1·83	477	1·44	317	1·30	240	1·60	178
29	2·55	773	2·35	691	1·76	449	1·44	317	1·35	260	1·60	178
30	2·45	732	2·35	691	1·85	486	1·35	281	1·35	256	1·60	178
31	2·30	670	2·32	678			1·34	277			1·70	176

*Shifting conditions Nov. 21 to Dec. 5.
†Ice conditions Dec. 5 to Dec. 31.

Monthly Discharge of Ghost River at Gillies' Ranch, for 1912.

(Drainage area, 367 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean	Per Square Mile.	Depth in inches on Drainage Area.	Total in Acre-feet.
January	144	100	128	0·35	0·40	7,841
February	112	96	99	0·27	0·29	5,721
March	137	96	115	0·32	0·37	7,098
April	342	76	134	0·36	0·40	7,950
May	718	133	358	0·98	1·13	22,005
June	1,371	96	300	0·82	0·92	17,826
July	1,695	219	1,073	2·92	3·37	65,976
August	1,101	498	653	1·78	2·05	40·151
September	670	449	545	1·48	1·65	32,430
October	486	277	395	1·07	1·23	24,288
November	338	180	278	0·757	0·845	16,542
December	294	176	196	0·534	0·615	12,052
The year					13·270	259·880

Discharge Measurements of Jumpingpound Creek near Jumping Pound, Alta., in 1906–8–9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1906.		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
June 15	J. F. Hamilton	103	289	0·60	2·70	162
June 16*	do				2·75	189
1908.						
May 6	P. M. Sauder	99·3	250	0·22	2·30	55
May 6*	do	49·4	65	0·88	2·30	57
July 23*	H. R. Carscallen	57·0	74	0·96	2·36	71
September 4	do	89·0	187	0·17	2·05	32
1909.						
June 28	J. C. Keith	95·0	212	0·53	2·48	113
July 20	do	87·0	195	0·33	2·24	64
September 7*	do	28·5	34	0·70	1·96	24

* Measurements taken at wading sections.

Daily Gauge Height and Discharge of Jumpingpound Creek near Jumping Pound, Alta., for 1908.

Day.	April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			2·40		5·00	751
2			2·30		5·30	829
3			2·30		4·70	673
4			2·30		5·00	751
5			2·30		5·30	829
6			2·30		5·00	751
7			2·30		4·70	673
8			2·50		4·00	491
9			2·80		3·90	465
10			2·70		3·60	387
11			2·60		3·50	361
12			2·50		3·50	361
13			2·70		3·40	336
14			2·80		3·40	336
15			3·00		3·30	311
16			3·30		3·30	311
17			3·30		3·20	286
18			3·10		3·20	286
19	2·50		3·20		3·10	261
20	2·45		3·30		3·30	311
21	2·40		3·30		3·30	311
22	2·40		3·20		3·20	286
23	2·35		3·20		3·20	286
24	2·30		3·10		3·10	261
25	2·30		3·10		3·00	236
26	2·30		3·20		3·00	236
27	2·30		3·30		3·30	311
28	2·40		3·20		3·20	286
29	2·40		3·20		3·00	236
30	2·40		3·50		3·00	236
31			3·70			

Daily Gauge Height and Discharge of Jumpingpound Creek, near Jumping Pound Alta., for 1908.—*Continued.*

Day.	July.		August.		September.		October.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·80	186	2·20	57	2·20	57	* 2·00	27
2	2·70	162	2·20	57	2·10	40	2·10	40
3	2·60	139	2·20	57	2·10	40	2·10	40
4	2·60	139	2·20	57	2·10	40	2·10	40
5	2·60	139	2·10	40	2·00	27	2·10	40
6	2·60	139	2·10	40	2·00	27	2·10	40
7	2·60	139	2·10	40	2·00	27	2·10	40
8	2·50	117	2·10	40	2·00	27	2·10	40
9	2·50	117	2·10	40	2·00	27	2·10	40
10	2·50	117	2·10	40	2·00	27	2·10	40
11	2·40	96	2·20	57	2·00	27	2·10	40
12	2·40	96	2·30	76	2·00	27	2·10	40
13	2·40	96	2·30	76	2·00	27	2·10	40
14	2·40	96	2·20	57	2·00	27	2·10	40
15	2·40	96	2·20	57	2·00	27	2·10	40
16	2·50	117	2·20	57	2·00	27	2·10	40
17	2·50	117	2·20	57	1·90	20	2·10	40
18	2·40	96	2·10	40	1·90	20	2·10	40
19	2·40	96	2·10	40	1·90	20	2·10	40
20	2·40	96	2·10	40	1·90	20	2·10	40
21	2·40	96	2·10	40	1·90	20	2·10	40
22	2·40	96	2·00	27	1·90	20	2·10	40
23	2·30	76	2·00	27	1·90	20	2·10	40
24	2·30	76	2·10	40	1·90	20	2·10	40
25	2·30	76	2·20	57	2·00	27	2·10	40
26	2·20	57	2·20	57	2·10	40	2·10	40
27	2·20	57	2·20	57	2·10	40		
28	2·20	57	2·20	57	2·10	40		
29	2·20	57	2·10	40	2·00	27		
30	2·20	57	2·20	57	2·00	27		
31	2·20	57	2·20	57				

Note.—Rating table does not apply to gauge heights previous to June 1st.

Daily Gauge Height and Discharge of Jumpingpound Creek near Jumping Pound, Alta., for 1909.

Day.	May.		June.		July.		August.		September.		October.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·60	139	3·30	311	2·30	76	2·50	117	2·00	27	1·90	20
2	2·60	139	3·20	286	2·30	76	2·40	96	2·00	27	1·90	20
3	2·70	162	3·10	261	2·30	76	2·40	96	2·00	27	1·90	20
4	2·70	162	3·10	261	2·30	76	2·40	96	2·00	27	1·90	20
5	2·60	139	3·20	286	2·30	76	2·40	96	2·00	27	1·90	20
6	2·50	117	3·20	286	2·40	96	2·40	96	2·00	27	1·90	20
7	2·50	117	3·20	286	3·00	236	2·30	76	2·00	27	1·90	20
8	2·40	96	3·10	261	2·80	186	2·30	76	2·00	27	1·90	20
9	2·40	96	3·10	261	2·70	162	2·30	76	2·00	27	1·90	20
10	2·30	76	3·00	236	2·70	162	2·30	76	2·00	27	1·90	20
11	2·40	96	3·00	236	2·60	139	2·40	96	2·00	27	1·90	20
12	2·60	139	2·90	211	2·60	139	2·30	76	2·00	27	1·90	20
13	2·80	186	2·90	211	2·70	162	2·30	76	2·00	27	1·90	20
14	2·80	186	2·80	186	2·70	162	2·20	57	2·00	27	1·90	20
15	2·70	162	2·80	186	2·60	139	2·20	57	2·00	27	1·90	20
16	2·70	162	2·70	162	2·50	117	2·20	57	2·00	27	1·90	20
17	2·80	186	2·70	162	2·50	117	2·20	57	2·00	27	1·90	20
18	2·80	186	2·60	139	2·40	96	2·20	57	2·00	27	1·90	20
19	2·60	139	2·60	139	2·40	96	2·20	57	2·00	27	1·90	20
20	2·90	211	2·50	117	2·30	76	2·10	40	2·00	27	1·90	20
21	3·10	261	2·50	117	2·30	76	2·10	40	1·90	20	1·90	20
22	3·30	311	2·50	117	2·30	76	2·10	40	1·90	20	1·90	20
23	3·30	311	2·50	117	2·30	76	2·10	40	1·90	20	1·90	20
24	4·00	491	2·60	139	2·20	57	2·10	40	1·90	20	1·90	20
25	4·00	491	2·60	139	2·20	57	2·10	40	1·90	20	1·90	20
26	3·80	439	2·60	139	2·60	139	2·10	40	1·90	20	1·90	20
27	3·60	387	2·50	117	2·60	139	2·10	40	1·90	20	1·90	20
28	3·50	361	2·40	96	2·90	211	2·00	27	1·90	20	1·90	20
29	3·40	336	2·40	96	2·80	186	2·00	27	1·90	20	1·90	20
30	3·30	311	2·40	96	2·70	162	2·00	27	1·90	20	1·90	20
31	3·30	311	.....	.....	2·50	117	2·00	27	.....	.....	1·90	20

Monthly Discharge of Jumpingpound Creek near Jumping Pound, Alta., for 1908–9.

(Drainage area, 178 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1908.						
June	829	236	414·8	2·330	2·600	24,684
July	186	57	101·9	0·572	0·659	6,264
August	57	27	49·7	0·279	0·322	3,056
September	57	20	28·7	0·161	0·180	1,710
October (1–26)	40	27	39·5	0·222	0·215	2,037
The period	.....	.....	.....	.....	.....	37,751
1909.						
May	491	76	222·8	1·251	1·442	13,698
June	311	96	188·6	1·059	1·182	11,221
July	236	57	121·3	0·681	0·785	7,459
August	117	27	61·9	0·347	0·400	3,806
September	27	20	24·7	0·138	0·154	1,468
October	20	20	20·0	0·112	0·129	1,230
The period	.....	.....	.....	.....	.....	38,882

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Discharge Measurements of Jumpingpound Creek at Sec. 30, Tp. 24, Rge. 4, W. 5th M., near Jumping Pound for 1910.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height	Discharge
1910		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 23	J. C. Keith	54	32·50	1·11	2·08	36·19†
June 28	do	54	166·53	0·16	1·97	26·38†
July 21	do	68	148·54	0·05	1·78	7·42
Aug. 16	do	77·8	163·67	0·156	1·98	25·53†
Sept. 7	do	90	177·03	0·214	2·10	38·02†
Sept. 30	H. R. Carscallen	101	215·14	0·22	2·12	47·22

† At wading stations near regular station.

Daily Gauge Height and Discharge of Jumpingpound Creek near Jumping Pound, for 1910.

Day.	April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			2·00	27	1·90	16
2			2·00	27	1·90	9
3			2·00	27	2·10	40
4			2·00	27	2·10	40
5			2·00	27	2·00	27
6			2·00	27	2·00	27
7			2·00	27	2·00	27
8			2·00	27	2·00	27
9	1·80	9	2·00	27	2·10	40
10	1·80	9	2·00	27	2·10	40
11	1·80	9	2·00	27	2·10	40
12	1·80	9	2·00	27	2·10	40
13	1·80	9	2,00	27	2·10	40
14	1·80	9	2·00	27	2·10	40
15	1·80	9	1·90	16	2·10	40
16	1·80	9	1·90	16	2·10	40
17	1·80	9	1·90	16	2·20	57
18	1·80	9	1·90	16	2·20	57
19	1·90	16	2·00	27	2·20	57
20	1·90	16	2·00	27	2·30	76
21	1·90	16	2·00	27	2·30	76
22	1·90	16	2·00	27	2·30	76
23	1·90	16	1·90	16	2·30	76
24	1·90	16	1·90	16	2·20	57
25	1·90	16	1·99	16	2·10	40
26	1·90	16	1·90	16	2·00	27
27	1·90	16	1·90	16	2·00	27
28	1·90	16	1·90	16	2·00	27
29	1·90	16	1·90	16	1·90	16
30	1·90	16	1·90	16	1·90	16
31			1·90	16		

Daily Gauge Height and Discharge of Jumpingpound Creek near Jumping Pound, for 1910.—*Continued.*

Day.	July.		August.		September.		October.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·90	16	1·60	3·5	1·80	9	2·10	40
2	1·80	9	1·60	3·5	1·80	9	2·10	40
3	1·80	9	1·60	3·5	1·80	9	2·10	40
4	1·80	9	1·60	3·5	1·80	9	2·10	40
5	1·80	9	9·70	5	1·90	16	2·10	40
6	1·80	9	1·80	9	1·95	21	2·10	40
7	1·80	9	1·90	16	2·12	43	2·00	27
8	1·80	9	1·70	5	2·20	57	2·00	27
9	1·80	9	1·70	5	2·20	57	2·00	27
10	1·80	9	1·70	5	2·20	57	1·90	16
11	1·80	9	1·70	5	2·20	57	1·90	16
12	1·80	9	1·80	9	2·20	57	1·90	16
13	1·80	9	1·90	16	2·20	57	1·90	16
14	1·70	5	2·00	27	2·30	76	1·80	9
15	1·70	5	2·00	27	2·30	76	1·80	9
16	1·70	5	2·00	27	2·30	76	1·80	9
17	1·70	5	1·90	16	2·40	96	1·80	9
18	1·70	5	1·70	5	2·40	96	1·80	9
19	1·70	5	1·70	5	2·50	117	1·80	9
20	1·70	5	1·70	5	2·50	117	1·80	9
21	1·70	5	1·70	5	2·50	117	1·80	9
22	1·70	5	1·70	5	2·50	117	1·80	9
23	1·70	5	1·80	9	2·40	96	1·70	5
24	1·70	5	1·80	9	2·40	96	1·70	5
25	1·60	3·5	1·70	5	2·30	76	1·70	5
26	1·60	3·5	1·70	5	2·30	76	1·70	5
27	1·60	3·5	1·70	5	2·30	76	1·70	5
28	1·60	3·5	1·70	5	2·20	57	1·70	5
29	1·60	3·5	1·80	9	2·20	57	1·70	5
30	1·60	3·5	1·80	9	2·10	40	1·70	5
31	1·60	3·5	1·80	9			1·70	5

Monthly Discharge of Jumpingpound Creek near Jumping Pound, for 1910.

(Drainage area, 187 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April (9–30)	16	9	12·8	·063	·052	560
May	27	16	22·4	·119	·137	1,377
June	76	9	40·6	·216	·241	2,416
July	16	3·5	6·56	·035	·040	403
August	27	3·5	8·9	·042	·048	547
September	117	9	64·0	·342	·382	3,808
October	40	5	16·5	·088	·101	1,014
The period						10,125

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Discharge Measurements of Jumpingpound Creek at Jumping Pound, Alta., in 1911.

Date.	Hydrographer.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 2	H. C. Ritchie	77	168·3	0·21	2·02	35·2
June 8	R. T. Sailman	99·8	215·7	0·83	2·56	178·2
July 12	L. R. Brereton	98	209·2	0·62	2·39	130·6
Aug. 16	do	109	268·5	1·30	2·92	350·7
Sept. 14	do	98	208·6	0·66	2·44	137·9
Oct. 19	do	75	169·7	0·36	2·23	60·2

Daily Gauge Height and Discharge of Jumpingpound Creek at Jumping Pound, Alta., for 1911.

Day.	May.		June.		July.		August.		September.		October.	
	Gauge Height	Discharge	Gauge Heigth	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge
	Feet'	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft
1	†2·02	30·8	3·30	548	2·98	382	2·35	106	2·56	184	2·47	149
2	2·02	30·8	3·20	496	2·99	387	2·53	172	2·54	176	2·49	156
3	†2·02	30·8	3·00	392	2·81	297	2·65	223	2·95	366	2·49	156
4	2·02	30·8	2·80	292	2·80	292	2·70	246	2·95	366	2·48	152
5	2·02	30·8	2·60	201	2·75	269	2·75	269	2·91	341	2·49	156
6	2·02	30·8	2·60	201	2·65	223	2·75	269	2·82	302	2·45	141
7	2·02	30·8	2·60	201	2·60	201	4·35	1,116	2·72	255	2·43	134
8	2·02	30·8	2·56	184	2·55	180	4·50	1,200	2·70	246	2·39	120
9	2·02	30·8	2·49	156	2·51	161	4·00	921	2·63	214	2·37	113
10	2·02	30·8	2·49	156	2·50	160	3·50	652	2·63	214	2·36	109
11	2·02	30·8	2·49	156	2·50	160	3·25	522	2·55	180	2·33	100
12	2·02	30·8	2·48	152	2·39	120	3·00	392	2·55	180	2·32	96·4
13	2·03	32·2	2·48	152	2·35	106	2·95	366	2·50	160	2·30	90
14	2·30	90	2·47	149	2·30	90	2·85	316	2·45	141	2·29	87·2
15	2·40	123	2·47	149	2·30	90	3·01	397	2·42	130	2·30	90
16	3·00	392	2·45	141	2·28	84·4	2·92	351	2·40	123	2·29	87·2
17	2·90	341	2·44	137	2·25	76	2·85	316	2·38	116	2·28	84·4
18	2·70	246	2·42	130	2·25	76	2·73	269	2·37	113	2·29	87·2
19	2·60	201	2·40	123	2·24	73·4	2·70	246	2·36	109	2·23	70·8
20	2·50	160	2·30	90	2·24	73·4	2·60	201	2·36	109		
21	2·40	123	2·21	65·6	2·24	73·4	2·70	246	2·38	116		
22	2·50	160	2·15	52	3·30	548	2·70	246	2·40	123		
23	2·40	123	2·15	52	3·25	522	2·65	223	2·46	145		
24	2·40	123	2·55	180	3·00	392	2·60	201	2·48	152		
25	2·40	123	2·91	346	2·78	283	2·73	260	2·49	156		
26	2·50	160	2·70	246	2·75	269	2·73	260	2·50	260		
27	2·50	160	2·65	223	2·65	223	2·70	246	2·50	160		
28	2·49	123	2·95	366	2·56	184	2·68	237	2·52	168		
29	2·50	160	2·95	366	2·45	141	2·62	210	2·49	156		
30	2·90	341	2·99	387	2·39	120	2·60	201	2·47	149		
31	3·00	392			2·35	106	1·58	193				

†No observations, gauge height interpolated.

Monthly Discharge of Jumpingpound Creek near Jumping Pound, for 1911.

(Drainage area, 187 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	392	30·8	127	0·679	0·78	7,809
June	548	52·0	216	1·155	1·29	12,853
July	548	73·4	205	1·096	1·26	12,605
August	1,200	106·0	357	1·909	2·20	21,951
September	366	109·0	184	0·984	1·10	10,949
October (1-19)	156	70·8	115	0·615	0·43	4,334
The period					7·06	70,501

Discharge Measurements of Jumpingpound Creek at Jumping Pound, Alta., in 1912.

Date.	Hydrographer.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
April 18	H. C. Ritchie	70·0	189·00	0·42	2·43	80·06
May 17	do	99·5	208·70	0·57	2·40	118·63
May 31	do	97·5	198·00	0·594	2·35	117·59
June 13	do	90·5	176·75	0·24	2·17	43·17
June 28	do	97·5	189·85	0·64	2·37	121·14
July 12	do	110·5	314·75	2·58	3·44	800·92
July 27	do	110·0	285·63	2·50	3·32	715·50
Aug. 9	do	97·5	190·35	0·92	2·42	174·74
Aug. 23	do	94·5	178·00	0·70	2·35	122·80
Sept. 3	H. R. Cram	97·5	196·70	0·78	2·37	152·60
Sept. 27	do	97·5	179·00	0·71	2·36	127·00
Oct. 10	do	96·5	189·00	0·71	2·37	134·00
Oct. 25	H. C. Ritchie	94·0	167·40	0·48	2·30	80·40
Nov. 7	do				2·54	114·30

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Daily Gauge Height and Discharge of Jumpingpound Creek near Jumping Pound, Alta., for 1912.

Day.	April.		May.		June.	
	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	2·82	308·00	2·34	112·60
2	....	....	2·55	165·00	2·36	121·80
3	....	....	2·50	140·00	2·40	141·00
4	....	....	2·76	280·00	2·32	103·80
5	....	....	2·68	234·00	2·39	95·00
6	....	....	2·58	182·00	2·27	82·40
7	....	....	2·55	174·00	2·25	74·00
8	....	....	2·53	166·00	2·29	90·80
9	....	....	2·55	177·00	2·28	84·60
10	....	....	2·43	120·00	2·25	74·00
11	....	....	2·39	104·00	2·20	56·00
12	....	....	2·35	89·00	2·18	50·00
13	....	....	2·35	90·00	2·15	41·00
14	....	....	2·35	90·50	2·25	74·00
15	....	....	2·40	115·00	3·35	736·00
16	....	....	2·41	118·50	3·40	772·00
17	....	....	2·40	118·00	3·03	512·40
18	*2·43	80·06	2·45	144·00	3·01	498·80
19	2·40	70·00	2·55	198·00	2·90	425·00
20	2·25	28·00	2·55	200·00	2·80	363·00
21	2·25	29·00	2·70	286·00	2·60	248·00
22	2·23	25·00	2·59	226·00	2·50	194·00
23	2·20	20·00	2·65	262·00	2·48	182·60
24	2·20	20·50	2·60	237·00	2·45	167·00
25	2·20	21·00	2·55	210·00	2·50	194·00
26	2·20	21·50	2·60	238·00	2·45	167·00
27	2·18	19·00	2·60	240·00	2·45	167·00
28	2·18	19·50	2·45	160·00	2·43	156·60
29	2·15	17·00	2·40	138·00	2·40	141·00
30	2·64	220·00	2·38	126·00	2·55	220·00
31	....	....	2·35	117·50	....	....

*Shifting conditions from April 18 to May 31.

Daily Gauge Height and Discharge of Jumpingpound Creek, near Jumping Pound, for 1912.—*Concluded.*

Day.	July.		August.		September.		October.		November.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·50	194·00	2·75	333·00	2·38	131·40	2·30	95·00	2·30	95·00
2	2·70	304·00	2·70	304·00	2·35	117·00	2·28	86·60	2·30	95·00
3	2·90	425·00	2·65	276·00	2·38	131·40	2·28	86·60	2·30	95·00
4	2·95	458·00	2·60	248·00	2·38	131·40	2·29	90·80	2·30	95·00
5	3·00	492·00	2·55	255·00	2·50	194·00	2·30	95·00	2·30	95·00
6	3·10	560·00	2·60	248·00	2·60	248·00	2·30	95·00	2·30	95·00
7	3·25	664·00	2·50	194·00	2·61	253·60	2·29	90·80	2·30	95·00
8	3·60	916·00	2·45	167·00	2·65	276·00	2·30	95·00	2·30	95·00
9	3·90	1,132·00	2·40	141·00	2·60	248·00	2·29	90·80	2·30	95·00
10	4·25	1,384·00	2·35	117·00	2·60	248·00	2·30	95·00	2·30	95·00
11	4·00	1,204·00	2·45	167·00	2·60	248·00	2·35	117·00	2·30	95·00
12	3·60	916·00	2·55	220·00	2·50	194·00	2·38	131·40	2·30	95·00
13	3·80	1,060·00	2·50	194·00	2·40	141·00	2·40	141·00	2·30	95·00
14	3·60	916·00	2·50	194·00	2·35	117·00	2·38	131·40	2·30	95·00
15	3·40	772·00	2·47	177·80	2·30	95·00	2·37	126·60	2·30	95·00
16	3·30	700·00	2·43	156·60	2·25	74·00	2·36	121·80	.....	.....
17	3·20	628·00	2·95	458·00	2·40	141·00	2·36	121·80	.....	.....
18	3·00	492·00	2·90	425·00	2·40	141·00	2·35	117·00	.....	.....
19	2·80	363·00	2·70	304·00	2·35	117·00	2·35	117·00	.....	.....
20	3·10	560·00	2·60	248·00	2·30	95·00	2·35	117·00	.....	.....
21	3·00	492·00	2·55	220·00	2·25	74·00	2·35	117·00	.....	.....
22	3·00	492·00	2·50	194·00	2·30	95·00	2·34	112·60	.....	.....
23	3·40	772·00	2·35	117·00	2·30	95·00	2·35	117·00	.....	.....
24	4·00	1,204·00	2·30	95·00	2·35	117·00	2·35	117·00	.....	.....
25	4·00	1,204·00	2·56	225·60	2·30	95·00	2·32	103·80	.....	.....
26	3·80	1,060·00	2·50	194·00	2·36	121·80	2·30	95·00	.....	.....
27	3·30	700·00	2·65	276·00	2·34	112·60	2·29	90·80	.....	.....
28	3·15	594·00	2·60	248·00	2·30	95·00	2·28	86·60	.....	.....
29	3·00	492·00	2·50	194·00	2·31	99·40	2·27	82·40	.....	.....
30	2·92	438·20	2·45	167·00	2·30	95·00	2·26	78·20	.....	.....
31	2·80	363·00	2·40	141·00	.....	.....	2·26	78·20	.....	.....

Note.—Gauge was not read after Nov. 15.

Monthly Discharge of Jumpingpound Creek near Jumping Pound, for 1912.

(Drainage area, 187 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per Square Mile.	Depth in inches on Drainage Area.	Total in Acre-feet.
April	220	19·0	45·4	0·24	0·116	1,171
May	308	89·0	175·9	0·94	1·084	10,816
June	772	41·0	211·5	1·13	1·261	12,585
July	1,384	194·0	708·1	3·78	4·358	43,539
August	333	95·0	222·6	1·19	1·372	13,685
September	276	74·0	144·7	0·77	0·859	8,611
October	131	78·2	104·6	0·56	0·646	6,429
November (1-15)	950	95·0	95·0	0·51	0·284	2,826
The period	.....	.....	.....	.....	9·980	99,662

Note.—No gauge readings after Nov. 15.

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Discharge Measurements of Bow River at Calgary, Alta., in 1908–9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1908.		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
April 29	P. M. Sauder	192·5	730	2·73	3·35	1,996
May 11	do	210·0	1,059	4·72	5·00	4,994
May 16	H. R. Carscallen	218·0	1,160	5·22	5·38	6,053
June 3	P. M. Sauder	298·6	1,893	6·92	8·03	13,099
July 20	H. R. Carscallen	287·9	2,234	4·82	6·99	10,779
Sept. 1	do	211·5	1,607	2·56	4·50	4,109
Oct. 9	P. M. Sauder	201·5	1,404	1·63	3·52	2,284
1909.						
April 23	P. M. Sauder	174·0	1,169	1·07	2·69	1,248
May 21	do	205·5	1,742	2·52	3·98	3,713
June 7	do	284·5	2,244	5·71	7·05	12,807
June 26	J. C. Keith	274·0	2,159	5·21	6·73	11,242
June 30	do	277·5	2,074	4·91	6·43	10,179
July 7	do	334·2	2,863	7·67	8·99	21,952
July 16	do	278·5	2,095	4·90	6·46	10,272
Aug. 6	do	228·5	1,821	3·85	5·46	7,019
Aug. 26	do	209·0	1,564	2·71	4·40	4,252
Sept. 17	do	203·5	1,425	2·18	3·785	3,014
Oct. 26	P. M. Sauder	196·5	1,306	1·50	3·30	1,958

Daily Gauge Height and Discharge of Bow River, at Calgary, Alta., for 1908.

Day.	May.		June.		July.		August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			6·70	9,090	6·70	9,490	5·50	6,400	4·60	4,300	3·80	2,790
2			8·95	16,325	6·60	9,210	5·60	6,660	4·40	3,900	3·80	2,790
3			8·25	13,820	7·20	11,070	5·50	6,400	4·30	3,700	3·80	2,790
4			8·45	14,550	7·70	12,720	5·50	6,400	4·30	3,700	3·80	2,790
5			9·50	18,450	7·50	12,090	5·30	5,900	4·30	3,700	3·80	2,790
6			9·60	18,880	7·00	10,500	5·30	5,900	4·30	3,700	3·70	2,620
7			9·45	18,330	7·00	10,520	5·30	5,900	4·20	3,510	3·70	2,620
8			9·20	17,390	7·00	10,540	5·40	6,150	4·20	3,510	3·70	2,620
9			8·9	16,280	6·90	10,260	5·30	5,900	4·20	3,510	3·60	2,450
10	5·00	4,990	9·50	18,570	7·60	12,530	5·30	5,900	4·20	3,510	3·40	2,110
11	5·00	4,990	9·10	17,080	7·60	12,550	5·30	5,900	4·20	3,510	3·40	2,110
12	5·10	5,200	9·0	16,710	7·50	12,230	5·30	5,930	4·20	3,510	3·40	2,110
13	5·30	5,640	8·8	15,993	7·40	12,250	5·30	5,900	4·10	3,330	3·40	2,110
14	5·30	5,640	8·2	13,890	7·50	12,270	5·20	5,650	4·20	3,510	3·40	2,110
15	5·35	5,750	7·90	12,800	7·50	12,293	5·00	5,160	4·30	3,700	3·40	2,110
16	5·40	5,860	8·00	13,160	7·50	12,310	4·90	4,930	4·30	3,700	3·40	2,110
17	5·75	6,660	8·30	14,300	7·50	12,330	4·90	4,930	4·30	3,700	3·40	2,110
18	5·65	6,425	7·80	12,660	7·40	12,030	4·90	4,930	4·50	4,100	3·30	1,940
19	5·55	6,195	7·40	11,430	7·30	11,720	4·90	4,930	4·50	4,100	3·40	2,110
20	5·50	6,080	7·40	11,460	7·00	10,780	4·90	4,930	4·40	3,900	3·50	2,280
21	5·45	5,970	7·20	10,860	6·90	10,470	4·90	4,930	4·30	3,700	3·30	1,940
22	5·30	5,640	7·00	10,260	6·90	10,470	4·90	4,930	4·20	3,510	3·30	1,940
23	5·30	5,640	6·70	9,430	6·70	9,850	4·90	4,930	4·20	3,510	3·30	1,940
24	5·20	5,420	6·50	8,893	6·70	9,850	4·90	4,930	4·20	3,510	3·30	1,940
25	5·30	5,640	6·70	9,450	6·70	9,850	5·10	5,400	4·20	3,510	3·40	2,110
26	5·50	6,080	7·60	12,180	6·50	9,240	5·10	5,400	4·20	3,510	3·40	2,110
27	5·50	6,080	8·10	13,960	6·30	8,640	5·10	5,400	4·20	3,510	3·40	2,110
28	5·50	6,080	7·60	12,300	6·20	8,340	4·80	4,710	3·90	2,970	3·40	2,110
29	5·50	6,080	7·30	11,320	6·00	7,760	4·80	4,710	3·90	2,970		
30	5·60	6,310	6·70	9,470	5·99	7,180	4·70	4,500	3·80	2,790		
31	5·90	7,020			5·50	6,400	4·60	4,300				

Daily Gauge Height and Discharge of Bow River, at Calgary, Alta., for 1909.

Day.	April.		May.		June.		July.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	2·70	1,280	6·60	11,100	6·70	11,130
2	.....	.....	2·90	1,620	7·60	15,230	6·90	11,910
3	.....	.....	3·30	2,370	8·60	20,220	7·00	12,330
4	.....	.....	3·70	3,130	8·30	18,660	7·30	13,610
5	.....	.....	3·00	1,800	7·90	16,670	7·50	14,480
6	.....	.....	2·90	1,620	7·60	15,230	7·50	14,480
7	.....	.....	2·80	1,440	7·00	12,600	9·00	22,020
8	.....	.....	2·80	1,440	6·60	10,971	8·90	21,490
9	.....	.....	2·70	1,280	6·30	9,884	8·50	19,380
10	.....	.....	2·80	1,440	6·30	9,873	8·30	18,340
11	.....	.....	3·30	2,370	6·60	10,936	7·80	15,860
12	.....	.....	3·10	1,990	7·50	14,684	7·60	14,940
13	.....	.....	3·50	2,750	7·80	16,054	7·30	13,610
14	.....	.....	3·50	2,750	8·20	18,024	7·10	12,750
15	.....	.....	3·70	3,130	8·10	17,504	6·70	11,130
16	.....	.....	3·50	2,750	8·00	16,988	6·50	10,400
17	.....	.....	3·30	2,370	8·20	17,974	6·50	10,400
18	.....	.....	3·30	2,370	8·30	18,470	6·40	10,040
19	.....	.....	3·70	3,130	8·20	17,941	6·20	9,360
20	2·70	1,280	4·00	3,760	8·20	17,925	6·00	8,690
21	2·70	1,280	4·00	3,760	8·00	16,910	5·80	8,040
22	2·70	1,280	4·20	4,200	7·90	16,391	5·80	8,040
23	2·70	1,280	4·30	4,430	7·70	15,441	5·70	7,740
24	2·70	1,280	4·80	5,640	7·10	12,776	5·80	8,040
25	2·80	1,440	5·50	7,520	6·90	11,922	5·90	8,360
26	2·80	1,440	5·90	8,740	6·80	11,510	6·00	8,690
27	2·80	1,440	5·70	8,120	6·50	10,400	6·80	11,510
28	2·90	1,620	6·00	9,050	6·50	10,400	6·70	11,130
29	2·70	1,280	6·20	9,700	6·50	10,400	6·30	9,700
30	2·70	1,280	6·30	10,040	6·40	10,040	6·10	9,020
31	.....	.....	6·20	9,700	.....	.....	6·00	8,690

Daily Gauge Height and Discharge of Bow River, at Calgary, Alta., for 1909.—*Continued.*

Day.	August.		September.		October.		November.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1.	5·90	8,360	4·40	4,290	3·60	2,640	3·20	1,880
2.	5·80	8,040	4·30	4,070	3·70	2,830	3·20	1,880
3.	5·70	7,740	4·30	4,070	3·70	2,830	3·20	1,880
4.	5·70	7,740	4·30	4,070	3·80	3,020	3·20	1,880
5.	5·60	7,440	4·40	4,290	3·70	2,830	3·20	1,880
6.	5·40	6,850	4·40	4,290	3·70	2,830	3·20	1,880
7.	5·30	6,570	4·40	4,290	3·60	2,640	....	....
8.	5·10	6,010	4·40	4,290	3·60	2,640	....	....
9.	5·00	5,730	4·30	4,070	3·60	2,640	....	....
10.	5·00	5,730	4·30	4,070	3·50	2,450	....	....
11.	4·90	5,470	4·30	4,070	3·50	2,450	....	....
12.	4·90	5,470	4·30	4,070	3·60	2,640	....	....
13.	4·80	5,220	4·20	3,850	3·60	2,640	....	....
14.	4·80	5,220	4·10	3,630	3·50	2,450	....	....
15.	4·80	5,220	4·00	3,410	3·50	2,450	....	....
16.	4·80	5,220	3·90	3,210	3·50	2,450	....	....
17.	4·70	4,980	3·80	3,020	3·40	2,260	....	....
18.	4·70	4,980	3·90	3,210	3·40	2,260	....	....
19.	4·70	4,980	3·90	3,210	3·40	2,260	....	....
29.	4·70	4,980	3·90	3,210	3·40	2,260	....	....
21.	4·70	4,980	3·90	3,210	3·40	2,260	....	....
22.	4·70	4,980	3·80	3,020	3·40	2,260	....	....
23.	4·70	4,980	3·80	3,020	3·30	2,070	....	....
24.	4·70	4,980	3·70	2,830	3·30	2,070	....	....
25.	4·60	4,740	3·60	2,640	3·30	2,070	....	....
26.	4·40	4,290	3·60	2,640	3·30	2,070	....	....
27.	4·50	4,510	3·60	2,640	3·20	1,880	....	....
28.	4·60	4,740	3·60	2,640	3·20	1,880	....	....
29.	4·50	4,510	3·50	2,450	3·20	1,880	....	....
30.	4·40	4,290	3·50	2,450	3·20	1,880	....	....
31.	4·40	4,290			3·20	1,880		

Monthly Discharge of Bow River at Calgary, Alta., for 1908-1909.

(Drainage area, 3,828 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per Square Mile.	Depth in inches on Drainage area.	Total in acre-feet.
1908.						
May (10-31)	7,093	5,063	5,954·9	1·556	1·273	259,850
June	18,880	9,050	13,701·5	3·579	3·993	815,290
July	13,134	6,631	10,801·4	2·822	3·253	664,167
August	6,873	4,496	5,652·2	1·476	1·702	347,536
September	4,496	2,904	3,648·2	0·953	1·063	217,084
October (1-28)	2,904	1,940	2,400·2	0·627	0·653	133,300
The period						2,437,227
1909.						
April (20-30)	1,620	1,280	1,354·5	0·354	0·145	29,553
May	10,126	1,280	4,176·2	1·091	1·258	256,784
June	20,306	10,069	14,527·4	3·795	4·234	864,444
July	22,051	8,060	12,263·2	3·204	3·694	754,018
August	8,680	4,314	5,878·9	1·536	1·771	361,482
September	4,758	2,490	3,703·0	0·967	1·084	220,343
October	3,106	1,880	2,422·9	0·633	0·729	148,977
November (1-6)	1,880	1,880	1,880·0	0·491	0·109	22,373
The period						2,657,974

Note.—The discharges of the Canadian Pacific Railway Company's canal have been added to those of Bow River at Cushing Bridge, in this table.

Discharge Measurements of Bow River at Calgary, in 1910.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 12	J. C. Keith	224·5	1,739·00	3·90	5·31	6,774·50
May 28	do	282·5	2,082·38	5·77	6·58	12,020·62
June 16	do	281·5	2,093·18	5·38	6·585	11,265·10
June 22	do	296·0	2,120·70	5·87	7·145	12,455·85
July 12	do	255·5	1,819·72	4·45	5·895	8,100·98
Aug. 6	do	227·0	1,733·50	3·90	5·475	6,755·10
Aug. 18	do	220·5	1,599·68	3·18	4·95	5,081·93
Sept. 20	do	207·0	1,451·90	2·50	4·20	3,640·74
Oct. 14	H. R. Carscallen	200·0	1,434·11	2·41	4·17	3,457·45

Daily Gauge Height and Discharge of Bow River, at Calgary, for 1910.

Day.	April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			4·6	4,860	5·8	8,380
2			4·5	4,620	6·0	9,070
3			4·2	3,930	6·1	9,430
4			4·2	3,930	5·8	8,380
5			4·2	3,930	5·6	7,710
6			4·1	3,700	5·9	8,720
7	2·7	760	4·6	4,860	5·9	8,720
8	2·9	1,160	5·1	6,190	6·3	10,170
9	2·9	1,160	5·2	6,480	6·1	9,430
10	2·9	1,160	5·5	7,399	6·0	9,070
11	2·9	1,160	5·6	7,710	6·2	9,800
12	2·9	1,160	5·4	7,080	7·1	13,240
13	2·9	1,160	5·2	6,480	7·3	14,020
14	2·9	1,160	5·1	6,190	6·8	12,070
15	2·9	1,160	5·0	5,910	6·7	11,680
16	2·9	1,160	4·9	5,640	6·7	11,680
17	2·9	1,160	4·9	5,640	*6·7	11,560
18	2·9	1,160	4·8	5,360	*7·3	13,640
19	2·9	1,160	4·9	5,640	*7·1	12,760
20	3·0	1,360	4·9	5,640	*6·9	11,800
21	3·0	1,360	4·9	5,640	*6·9	11,680
22	3·1	1,560	4·8	5,360	7·0	11,880
23	3·2	1,760	5·0	5,910	6·6	10,430
24	3·2	1,760	5·6	7,710	6·3	9,390
25	3·5	2,380	5·9	8,720	6·1	8,710
26	4·0	3,470	6 5	10,920	6·1	8,710
27	4·2	3,930	6·8	12,070	6·4	9,730
28	4·5	4,620	6·6	11,300	6·6	10,430
29	4·7	5,110	6·5	10,920	6·6	10,430
30	4·6	4,860	6·0	9,070	6·5	10,080
31			5·8	8,380		

*Changing conditions.

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Daily Gauge Height and Discharge of Bow River, at Calgary, for 1910.—*Continued.*

Day.	July.		August.		September.		October.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	6·5	10,080	4·8	4,910	4·1	3,310	3·9	2,900
2	6·3	9,390	4·8	4,910	4·0	3,100	3·9	2,900
3	6·1	8,710	4·8	4,910	4·0	3,100	3,9	2,900
4	6·1	8,710	4·8	4,910	4·0	3,100	3·9	2,900
5	6·0	8,380	4·9	5,160	4·1	3,310	3·8	2,710
6	5·9	8,060	5·475	6,745	4·3	3,740	3·8	2,710
7	5·9	8,060	5·7	7,430	4·3	3,740	3·9	2,900
8	5·9	8,060	5·6	7,120	4·3	3,740	4·0	3,100
9	5·9	8,060	5·4	6,520	4·2	3,520	4·0	3,100
10	5·9	8,060	5·4	6,520	4·1	3,310	4·0	3,100
11	5·9	8,060	5·4	6,520	4·0	3,100	4·2	3,520
12	5·9	8,060	5·4	6,520	4·0	3,100	4·2	3,520
13	5·9	8,060	5·4	6,520	4·0	3,100	4·3	3,740
14	6·0	8,380	5·4	6,520	4·0	3,100	4·2	3,520
15	6·1	8,710	5·4	6,520	4·1	3,310	4·2	3,520
16	6·3	9,390	5·3	6,230	4·1	3,310	4·1	3,310
17	6·3	9,390	5·2	5,950	4·3	3,740	4·2	3,520
18	6·3	9,390	5·0	5,420	4·3	3,740	4·2	3,520
19	6·3	9·390	4·8	4,910	4·3	3,740	4·3	3,740
20	6·3	9,390	4·8	4,910	4·3	3,740	4·2	3,520
21	6·3	9,390	4·8	4,910	4·3	3,740	4·2	3,520
22	6·1	8,710	4·8	4,910	4·3	3,740	4·1	3,310
23	5·9	8,060	4·7	4,660	4·3	3,740	4·0	3,100
24	5·7	7,430	4·7	4,660	4·3	3,740	4·0	3,100
25	5·5	6,820	4·5	4,190	4·3	3,740	4·0	3,100
26	5·3	6,230	4·4	3,960	4·3	3,740	3·9	2,900
27	5·2	5,950	4·3	3,740	4·2	3,520	3·8	2,710
28	5·0	5,420	4·2	3,520	4·1	3,310	3·7	2,520
29	4·9	5,160	4·1	3,310	4·0	3,100	3·6	2,330
30	4·8	4,910	4·1	3,310	3·9	2,900	3·6	2,330
31	4·8	4,910	4·1	3,310			3·6	2,330

Monthly Discharge of Bow River at Calgary, for 1910.

(Drainage area, 3,900 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April 6-30	5,110	760	1,952	0·500	0·446	92,925
May	12,070	3,700	6,683	1·710	1·970	410,935
June	14,020	7,710	10,427	2·670	2·980	620,129
July	10,080	1,910	7,961	2·040	2·350	489,480
August	7,430	3,310	5,279	1·350	1·560	324,094
September	3,740	2,900	3,441	0·882	0·984	204,730
October	3,740	2,330	3,094	0·793	0·914	190,216
The period						2,332,809

Discharge Measurements of Bow River at Calgary, Alta., in 1910*-1911.

Date.	Hydrographer.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1910		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Nov. 25	H. R. Carscallen	170·6	491·8	3·22	1·71	1,583†x
Dec. 13	do	244·8	738·4	1·76	1·67	1,302x
1911						
Jan. 4	H. R. Carscallen				1·87	600·8‖x
Feb. 3	do	212	311·4	3·02	3·60	942·x
Feb. 22	do	212	286·3	2·88	3·34	823·4x
Mar. 11	do	212	370·6	2·65	3·30	832·x
Apr. 24	H. C. Ritchie	284	755·4	1·90	1·57	1,438
May 8	do	290·5	901·4	2·66	2·37	2,394
May 15	do	290·5	881·1	2·63	2·36	2,317
May 26	do	294	964·8	3·02	2·70	2,916
June 9	B. Russell	307	1,428	4·85	4·15	6,936
June 19	do	320	1,962	6·85	5·68	13,438
July 6	do	315·8	1,808	5·58	4·82	10,093
Aug. 12	H. Brown	312	1,658	4·96	4·44	8,224
Aug. 28	do	293	1,451	3·89	3·76	5,643
Sept. 12	do	298·8	1,295	3,38	3·30	4,371
Sept. 26	do	295	1,194	2·79	2·87	3,330
Nov. 23	N. M. Sutherland	242	795·4	1·95	2·19	1,551x
Dec. 7	do	293	851·7	0·89	4·44	5,754·7x
Dec. 22	do	277	795·3	0·91	4·30	722·9x

* Other gaugings at the old gauging station in 1910 were published in the Second Annual Report. Data are insufficient to compute daily discharges in November and December of 1910.

† Gauging made at Centre St. bridge.

‖ Gauging was made at traffic bridge on sec. 14 and the discharge of Elbow river was deducted to obtain the discharge of Bow river at the regular station.

x Ice conditions.

Daily Gauge Height and Discharge of Bow River at Calgary, Alta., for 1910.

Day.	November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			1·45	1,270
2			1·60	1,380
3			1·65	1,410
4			1·55	1,310
5			1·62	1,350
6			1·75	1,450
7			1·79	1,470
8			1·97	1,620
9			1·97	1,600
10			1·97	1,580
11			2·05	1,660
12			1·67	1,300
13			2·04	1,590
14			2·05	1,560
15			1·97	1,470
16			1·78	1,240
17			1·85	1,250
18			1·73	1,130
19			1·89	1,199
20			1·80	1,100
21			1·78	1,050
22			1·69	970
23			1·78	980
24			1·44	810
25			1·70	880
26			1·74	860
27			1·75	820
28			1·80	810
29	1·30	1,108	1·80	770
30	1·40	1,230	1·64	700
31			1·97	760

Note.—Ice conditions during the whole period and daily discharges are therefore only approximate.

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Daily Gauge Height and Discharge of Bow River at Calgary, Alta., for 1911.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·83	690	3·74	960	3·35	840	2·64	890	1·64	1,495	3·87	5,970
2	1·70	640	3·65	940	3·30	820	2·47	860	1·70	1,550	4·05	6,600
3	1·42	600	3·57	928	3·42	868	2·57	940	1·83	1,670	4·17	7,032
4	1·90	600	3·73	1,005	3·40	860	2·44	930	1·84	1,680	4·96	10,144
5	2·38	*	3·67	975	3·40	860	2·45	980	1·98	1,836	4·75	9,240
6	2·87		3·68	980	3·35	840	2·67	1,120	2·25	2,170	4·55	8,450
7	3·02		3·66	970	3·35	840	2·75	1,200	2·33	2,288	4·32	7,576
8	3·73		3·67	975	3·37	848	2·57	1,170	2·35	2,320	4·30	7,500
9	3·85		3·67	975	3·36	844	2·70	1,270	2·37	2,352	4·27	7,392
10	3·44		3·65	965	3·35	840	2·73	1,330	2·34	2,304	4·12	6,852
11	2·95		3·65	965	3·35	840	2·64	1,340	2·27	2,198	4·10	6,780
12	3·12		3·70	990	3·35	840	2·50	1,320	2·24	2,156	4·22	7,212
13	3·45		3·63	955	3·35	840	2·45	1,340	2·34	2,304	4·57	8,526
14	3·80		3·55	920	3·40	860	1·84	1,046	2·37	2,352	5·85	14,290
15	4·10		3·54	916	3·45	880	1·97	1,180	2·37	2,352	5·97	14,890
16	4·85		3·50	900	3·37	848	2·05	1,390	2·40	2,400	6·05	15,300
17	4·86		3·37	848	3·37	848	1·87	1,220	2·97	3,534	6·00	15,040
18	4·75		3·45	880	3·33	832	2·07	1,450	2·94	3,468	5·84	14,240
19	4·55		3·43	872	3·46	884	1·67	1,190	2·90	3,380	5·75	13,890
20	4·46	*	3·24	796	3·60	940	1·70	1,270	2·85	3,270	5·60	13,320
21	4·37	1,000	3·43	872	3·56	924	1·76	1,390	2·85	3,270	5·52	13,180
22	4·30	990	3·35	840	3·56	924	1·88	1,560	3·00	3,600	5·47	13,150
23	4·27	1,000	3·42	868	3·56	924	1·15	1,060	3·05	3,720	5·77	14,340
24	4·27	1,020	3·24	796	3·35	840	1·56	1,428	2·97	3,534	6·10	15,740
25	4·05	950	3·44	876	3·15	810	2·33	2,288	2·90	3,380	6·25	16,460
26	3·93	910	3·44	876	3·08	820	1·73	1,577	2·77	3,094	6·05	15,840
27	3·67	830	3·45	880	2·95	810	1·70	1,550	2·69	2,920	5·56	14,080
28	3·93	960	3·43	872	2·95	850	1·66	1,514	2·65	2,840	5·47	13,330
29	3·94	980	.....	.....	2·80	830	1·68	1,532	2·59	2,722	5·47	13,330
30	3·90	990	.....	.....	2·82	880	1·67	1,523	2·82	3,204	5·49	13,430
31	3·97	1,040	.....	.....	2·70	870	.....	.....	3·00	3,600	.....	.....

* Not sufficient data to compute discharge from Jan. 5 to Jan. 20.

Daily Gauge Height and Discharge of Bow River at Calgary, Alta., for 1911.—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	5·55	13,730	4·15	7,000	3·65	5,310	2·78	3,116	1·93	1,776	4·30	1,070
2	5·45	13,230	4·16	7,040	3·67	5,370	2·75	3,050	1·92	1,764	4·30	980
3	5·40	12,980	4·18	7,120	3·70	5,460	2·75	3,050	1·92	1,764	4·52	1,050
4	5·30	12,480	4·37	7,908	4·00	6,420	2·73	3,006	1·93	1,776	4·55	990
5	5·06	11,280	4·45	8,280	3·97	6,312	2·68	2,900	1·95	1,800	4·53	880
6	4·74	9,680	4·45	8,280	3·85	5,910	2·65	2,840	1·95	1,800	4·50	770
7	4·77	9,830	5·05	11,230	3·77	5,670	2·75	3,050	1·85	1,690	4·45	744
8	5·05	11,230	5·83	15,130	3·65	5,310	2·85	3,270	1·45	1,340	4·40	748
9	4·95	10,730	4·97	10,830	3·55	5,020	2·75	3,050	1·43	1,324	4·50	740
10	4·75	9,730	4·73	9,630	3·48	4,828	2·42	2,432	1·40	1,300	4·43	746
11	4·85	10,230	4·55	8,760	3·40	4,750	2·45	2,480	1·25	1,185	4·51	739
12	4·54	8,712	4·45	8,280	3·40	4,620	2·40	2,400	1·20	1,150	4·37	750
13	4·42	8,136	4·30	7,600	3·37	4,542	2·42	2,432	0·90	960	4·46	743
14	4·40	8,040	4·25	7,400	3·35	4,490	2·40	2,400	1·32	1,200	4·47	742
15	4·58	8,904	4·23	7,320	3·32	4,412	2·23	2,142	1·50	1,295	4·25	760
16	4·53	8,664	4·20	7,200	3·32	4,412	2·18	2,076	2·00	1,700	4·47	742
17	4·60	9,000	4·15	7,000	3·25	4,230	2·43	2,448	2·35	2,080	4·37	750
18	4·65	9,240	4·00	6,420	3·23	4,178	2·40	2,400	2·47	2,200	4·32	754
19	4·67	9,336	4·00	6,420	3·20	4,100	2·30	2,240	2·48	2,160	4·25	760
20	4·57	8,856	3·97	6,312	3·05	3,720	2·17	2,064	2·48	2,120	4·32	754
21	4·52	8,616	3·95	6,240	3·10	3,840	2·25	2,170	2·15	2,010	4·37	750
22	4·53	8,664	3·95	6,240	3·05	3,720	2·15	2,040	2·37	1,840	4·34	753
23	4·55	8,760	3·90	6,060	3·00	3,600	2·17	2,064	2·35	1,720	4·35	752
24	4·45	8,280	3·85	5,910	2·97	3,534	2·20	2,100	2·35	1,740	4·55	736
25	4·40	8,040	3·85	5,910	2·95	3,490	2·23	2,142	2·30	1,660	4·67	726
26	4·46	8,328	3·90	6,060	2·90	3,380	2·25	2,170	2·25	1,610	4·75	720
27	4·55	8,760	3·85	5,910	2·88	3,336	2·13	2,016	2·23	1,590	5·51	659
28	4·40	8,040	3·75	5,610	2·85	3,270	2·10	1,980	4·28	1,360	5·35	672
29	4·25	7,400	3·70	5,460	2·80	3,160	2·10	1,980	4·27	1,230	5·15	688
30	4·23	7,320	3·63	5,250	2·80	3,160	1·97	1,824	4·25	1,120	5·35	672
31	4·15	7,000	3·70	5,460	.....	.....	1·95	1,800	.....	.....	5·62	650

Note.—Ice conditions during January, February, March, November and December. Daily discharges for those months are only approximate, particularly December which may be a little low.

SESSIONAL PAPER No. 25e

Monthly Discharge of Bow River near Calgary, Alta., for 1910-1911

(Drainage area, 3,138 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
1910						
November 29-30	1,230	1,180	1,205	0·348	0·03	4,780
December	1,660	700	1,205	0·384	0·44	74,093
The period					0·47	78,873
1911						
January (1-4) (21-30)	1,040	600	880	0·280	0·16	26·182
February	1,005	796	914	0·291	0·30	50,671
March	940	810	857	0·273	0·31	52,695
April	2,288	860	1,292	0·412	0·46	76,879
May	3,720	1,496	2,676	0·852	0·98	164,541
June	16,460	5,970	11,434	3·640	4·06	680,370
July	13,730	7,000	9,459	3·010	3·47	581,611
August	15,130	5,250	7,396	2·360	2·72	454,762
September	6,420	3,160	4,452	1·420	1·58	264,912
October	3,270	1,800	2,424	0·772	0·89	149,046
November	2,200	960	1,609	0·513	0·57	95,740
December	1,070	650	774	0·247	0·28	47,591
The period					15·78	2,645,090

Discharge Measurements of Bow River at Calgary, in 1912.

Date.	Hydrographer.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
*Jan. 15.	N. McL. Sutherland	286	1,004·4	1·23	6·38	1,236·2
*Jan. 30	do	286	862·3	1·35	6·49	1,166·6
*Feb. 10.	do	315	964·7	1·25	6·25	1,204·0
*Feb. 23.	do	287	807·0	1·24	5·99	999·0
*Mar. 7.	do	287	755·2	1·15	5·74	869·4
*Mar. 22	do	287	722·7	1·07	5·62	824·6
May 2	H. C. Ritchie	285·5	950·6	1·84	4·185	1,752·7
May 7.	F. R. Burfield	287	1,053·8	2·22	4·41	2,338·5
May 21	do	299	1,329·1	3·34	5·35	4,434·2
June 8	do	291·5	1,142·1	2·56	4·66	2,919·0
June 21	do	321	1,975·0	6·10	7·36	12,047·5
July 9	do	323	2,107·5	6·71	7·78	14,149·0
July 15	do	324	2,063·0	6·61	7·60	13,618·1
July 29	do	313·5	1,713·8	5·18	6·69	8,872·9
Aug. 8	do	306·5	1,150·6	1·45	6·11	6,459·7
Aug. 22	do	313·5	1,596·4	5·36	6·56	8,552·7
Sept. 4	do	303·5	1,298·6	4·31	5·79	5,599·6
Sept. 20	do	300·5	1,235·4	3·81	5·51	4,741·7
Oct. 4	do	294·5	1,056·3	3·04	4·91	3,209·0
Oct. 21	do	292·5	1,025	2·82	4·75	2,896·0
Oct. 31	do	292	938	2·37	4·46	2,226·0
Nov. 14	do	287·5	927	2·50	4·39	2,313·0

*Ice conditions.

Daily Gauge Height and Discharge of Bow River at Calgary, for 1912.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	5·65	680	6·35	1,190	5·94	974	5·00	1,740	4·40	2,420	5·15	3,805
2	5·65	680	6·30	1,070	5·95	980	4·95	1,850	4·18	1,748	5·10	3,680
3	5·77	720	6·30	1,080	5·97	992	4·93	1,990	4·10	1,620	4·97	3,358
4	5·75	720	6·25	1,080	5·98	998	4·95	2,160	4·30	1,950	4·97	3,358
5	6·06	880	6·15	1,060	5·97	992	4·80	2,170	4·32	1,984	4·95	3,310
6	5·76	720	6·15	1,070	5·95	980	4·40	2,020	4·32	1,984	4·73	2,796
7	6·25	1,000	6·20	1,110	5·71	855	4·20	1,780	4·31	1,967	4·55	2,420
8	5·95	830	6·25	1,160	5·68	840	4·10	1,620	4·40	2,120	4·75	2,840
9	6·25	1,000	6·23	,160	5·65	825	4·40	2,120	4·42	2,160	5·00	3,430
10	6·21	980	6·20	1,160	5·85	925	4·27	1,899	4·39	2,103	5·52	4,780
11	6·05	870	6·15	1,100	5·90	950	4·15	1,700	4·38	2,086	5·52	4,780
12	6·07	990	6·13	1,088	5·90	950	4·05	1,540	4·43	2,180	5·72	5,392
13	6·35	1,070	6·12	1,082	5·68	840	4·03	1,508	4·42	2,160	5·98	6,258
14	6·35	1,070	6·12	1,082	5·90	950	4·03	1,508	4·53	2,380	6·42	7,629
15	6·31	1,197	6·10	1,070	5·80	900	4·05	1,540	5·03	3,505	6·99	10,474
16	6·50	1,330	6·10	1,070	5·75	875	4·30	1,950	5·37	4,362	7·45	12,625
17	6·95	1,670	6·05	1,040	5·80	900	4·23	1,831	5·63	5,113	7·72	13,894
18	6·65	1,410	6·05	1,040	5·40	710	4·15	1,700	5·55	4,870	7·70	13,800
19	6·65	1,410	6·03	1,028	5·75	875	4·08	1,588	5·53	4,810	7·62	13,424
20	6·11	1,040	5·92	962	5·75	875	3·92	1,332	5·45	4,580	7·50	12,860
21	6·37	1,210	5·92	962	5·80	900	3·81	1,183	5·33	4,258	7·38	12,296
22	6·65	1,370	5·93	968	5·65	825	3·70	1,040	5·33	4,258	7·35	12,155
23	6·65	1,370	5·94	974	5·45	850	3·72	1,066	5·30	4,180	7·26	11,732
24	6·60	1,310	5·94	974	5·69	1,110	3·75	1,105	5·27	4,105	7·20	11,450
25	6·65	1,350	5·95	980	5·69	1,240	3·75	1,105	5·25	4,055	7·13	11,121
26	6·65	1,320	5·95	980	5·50	1,250	3·77	1,131	5·43	4,524	7·07	10,842
27	6·65	1,320	5·97	992	5·50	1,400	3·75	1,105	5·75	5,485	7·00	10,520
28	6·65	1,300	5·97	992	5·40	1,450	3·77	1,131	5·75	5,485	7·02	10,612
29	6·65	1,300	5·95	980	5·25	1,490	3·93	1,348	5·63	5,113	6·95	10,290
30	6·65	1,270	.....	.....	5·25	1,640	3·87	1,261	5·53	4,810	6·73	9,295
31	6·35	1,080	.....	.....	5·00	1,590	.....	.....	5·35	4,310	.....	.....

Notes.—Ice conditions from Jan. 1 to Apr. 6.
From Jan. 1 to Jan. 14 extremely cold.

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Daily Gauge Height and Discharge of Bow River at Calgary, for 1912. *Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	6·51	8,333	6·38	7,800	6·22	7,160	5·00	3,430	4·45	2,220	4·01	1,420
2	6·23	7,200	6·34	7,640	6·13	6,814	5·00	3,439	4·60	2,520	4·03	1,400
3	6·40	7,880	6·37	7,760	5·93	6,078	4·99	3,406	4·62	2,562	3·96	1,230
4	6·23	7,200	6·35	7,680	5·61	5,051	4·98	3,382	4·62	2,562	4·30	1,720
5	6·15	6,890	6·37	7,760	5·47	4,636	4·97	3,358	4·60	2,520	4·28	1,640
6	6·21	7,120	6·30	7,480	5·58	4,960	4·95	3,310	4·55	2,420	4·16	1,400
7	6·77	9,475	6·26	7,320	5·69	5,299	4·94	3,286	4·48	2,280	4·14	1,300
8	7·19	11,403	6·19	7,042	5·77	5,547	4·97	3,358	4·45	2,220	4·18	1,320
9	7·77	14,129	6·12	6,776	5·74	5,454	4·99	3,406	4·53	2,380	4·16	1,230
10	8·00	15,210	6·02	6,404	5·68	5,268	5·03	3,535	4·50	2,320	4·10	1,120
11	7·72	13,894	6·08	6,626	5·73	5,423	5·01	3,455	4·45	2,220	3·95	900
12	7·67	13,659	6·13	6,814	5·81	5,673	4·99	3,406	4·43	2,180	3·64	580
13	7·49	12,813	6·13	6,814	5·69	5,299	4·96	3,334	4·40	2,120	3·78	670
14	7·93	14,881	5·95	6,150	5·60	5,020	4·93	3,262	4·41	2,140	3·98	820
15	7·70	13,800	5·91	6,006	5·58	4,960	4·84	3,046	4·29	1,933	3·95	760
16	7·45	12,625	6·30	7,480	5·55	4,870	4·83	3,022	4·21	1,797	4·07	840
17	7·25	11,685	5·29	7,440	5·49	4,692	4·80	2,950	4·25	1,865	4·14	880
18	6·90	10,060	6·57	8,591	5·48	4,664	4·82	2,998	4·29	1,933	4·09	800
19	6·70	9,160	6·73	9,295	5·46	4,608	4·84	3,046	4·45	2,220	4·30	980
20	6·83	9,745	6·70	9,160	5·38	4,388	4·86	3,094	4·40	2,120	4·21	850
21	6·67	9,028	6·68	9,072	5·30	4,180	4·83	3,022	4·38	2,086	4·33	940
22	6·50	8,290	6·67	9,028	5·31	4,206	4·80	2,950	4·35	2,035	4·34	920
23	7·15	11,215	6·65	8,940	5·33	4,258	4·65	2,625	4·30	1,950	4·33	860
24	7·88	14,646	6·60	8,720	5·31	4,206	4·68	2,688	4·33	2,001	4·32	810
25	7·92	14,834	6·92	10,152	5·27	4,105	4·70	2,739	4·36	2,052	4·29	760
26	7·45	12,625	7·13	11,121	5·24	4,030	4·69	2,709	4·29	1,933	4·23	680
27	7·05	10,750	7·06	10,796	5·20	3,930	4·65	2,625	3·88	1,274	4·16	580
28	6·91	10,106	7·03	10,658	5·13	3,755	4·67	2,667	3·93	1,348	4·38	760
29	6·62	8,808	6·72	9,250	5·06	3,580	4·70	2,739	4·05	1,540	4·42	760
30	6·53	8,419	6·73	9,295	4·95	3,310	4·60	2,520	4·04	1,524	4·45	750
31	6·44	8,044	6·47	8,167	..	.....	4·46	2,240			4·61	870

Monthly Discharge of Bow River at Calgary, for 1912.

(Drainage area, 3,138 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per Square Mile.	Depth in inches on Drainage Area.	Total in Acre-feet.
January	1,670	680	1,109	0·35	0·40	68,189
February	1,160	980	1,048	0·33	0·36	60,284
March	1,640	825	1,030	0·33	0·38	63,330
April	2,170	1,040	1,571	0·50	0·56	93,480
May	5,485	1,620	3,432	1·09	1·26	211,024
June	13,894	2,420	8,185	2·61	2·91	487,040
July	15,210	6,890	10,772	3·43	3·96	662,400
August	11,121	6,006	8,169	2·60	3·00	502,290
September	7,160	3,310	4,847	1·54	1·72	288,420
October	3,505	2,240	3,064	0·98	1·12	188,400
November	2,562	1,274	2,076	0·66	0·74	123,590
December	1,720	580	985	0·31	0·36	60,565
The year	....	....	....	....	16·77	2,809,012

Discharge Measurements of Elbow River at Calgary, Alta., in 1908-1909.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1908.		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 8	P. M. Sauder	132·5	280	0·76	1·00	212
May 15	H. R. Carscallen	137·5	369	1·49	1·655	550
June 6	P. M. Sauder	158·5	922	5·34	5·30	4,925
July 21	H. R. Carscallen	139·5	370	1·43	1·67	529
July 25	do	139·0	350	1·27	1·525	445
Sept. 3	do	138·0	303	0·95	1·115	287
Oct. 7	P. M. Sauder	135·0	288	0·87	1·05	252
1909.						
May 7	H. R. Carscallen	133·0	278	0·83	0·755	230
May 18	P. M. Sauder	138·0	355	1·35	1·325	478
May 26	do	157·0	667	3·72	3·43	2,487
June 8	J. C. Keith	141·0	467	2·09	2·11	976
June 24	do	140·0	444	1·94	1·94	860
July 2	do	140·0	425	1·82	1·82	775
July 15	do	139·0	415	1·80	1·76	749
Aug. 7	do	138·0	359	1·37	1·40	493
Aug. 30	do	135·0	294	0·92	0·975	270

Daily Gauge Height and Discharge of Elbow River, at Calgary, Alta., for 1908.

Day.	May.		June.		July.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			3·35	2,022	2·15	882
2			5·70	5,615	2·30	1,000
3			4·40	3,435	2·30	1,000
4			5·00	4,400	2·30	1,000
5			5·60	5,440	2·30	1,000
6			5·60	5,440	2·20	920
7			4·85	4,152	2·15	882
8	1·00	212	4·15	3,062	2·10	845
9	1·50	460	3·85	2,637	2·10	845
10	1·40	410	3·70	2,449	2·10	845
11	1·30	360	3·70	2,440	2·05	810
12	1·45	435	3·50	2,195	2·00	775
13	1·55	490	3·25	1,910	2·00	775
14	1·65	550	3·00	1,640	1·90	705
15	1·70	580	3·00	1,640	1·90	705
16	1·75	610	3·00	1,640	1·80	640
17	2·35	1,040	2·70	1,340	1·80	640
18	2·15	882	2·50	1,165	1·90	705
19	2·00	775	2·50	1,165	1·90	705
20	2·05	810	2·65	1,295	1·80	640
21	2·05	810	2·70	1,340	1·80	640
22	2·00	775	2·55	1,207	1·75	610
23	1·90	705	2·50	1,165	1·70	580
24	1·90	705	2·55	1,207	1·70	580
25	1·95	740	2·80	1,435	1·60	520
26	2·05	810	2·95	1,587	1·50	469
27	2·10	845	2·95	1,587	1·50	460
28	2·10	845	2·70	1,340	1·40	410
29	2·10	845	2·40	1,080	1·40	410
30	2·05	810	2·25	960	1·30	360
31	2·50	1,165			1·30	360

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Daily Gauge Height and Discharge of Elbow River, at Calgary, Alta., for 1908.—*Continued.*

Day.	August.		September.		October.		November.	
	Gauge Height.	Discharge.	Gauge Height	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1.	1·30	360	1·20	310	1·10	260	1·30	360
2.	1·30	360	1·20	310	1·10	260	1·20	310
3.	1·30	360	1·20	310	1·10	260	1·10	260
4.	1·30	360	1·20	310	1·10	260	1·00	212
5.	1·30	360	1·20	310	1·10	260	1·00	212
6.	1·20	310	1·20	310	1·10	260	1·00	212
7.	1·20	310	1·20	310	1·10	260	1·00	212
8.	1·20	310	1·20	310	1·10	260	1·00	212
9.	1·20	310	1·10	260	1·10	260	1·00	212
10.	1·20	310	1·10	260	1·10	260	1·00	212
11.	1·25	335	1·10	260	1·10	260	1·00	212
12.	1·30	360	1·10	260	1·10	260	1·00	212
13.	1·30	360	1·10	260	1·00	212		
14.	1·30	360	1·10	260	1·00	212		
15.	1·30	360	1·10	260	1·00	212		
16.	1·30	360	1·10	260	1·00	212		
17.	1·20	310	1·10	260	1·00	212		
18.	1·20	310	1·10	260	1·00	212		
19.	1·20	310	1·10	260	1·00	212		
20.	1·20	310	1·10	260	1·00	212		
21.	1·10	260	1·10	260	1·00	212		
22.	1·10	260	1·10	260	1·00	212		
23.	1·10	260	1·10	260	1·00	212		
24.	1·40	410	1·15	285	1·00	212		
25.	1·40	410	1·20	310	1·00	212		
26.	1·35	385	1·20	310	1·00	212		
27.	1·30	360	1·20	310	1·05	236		
28.	1·20	310	1·20	310	1·10	260		
29.	1·20	310	1·10	260	1·20	310		
30.	1·20	310	1·10	260	1·25	335		
31.	1·20	310			1·30	360		

Daily Gauge Height and Discharge of Elbow River, at Calgary, Alta., for 1909.

Day.	May.		June.		July.		August.		September.		October.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	0·60	220	3·34	2,370	1·89	823	1·72	695	0·97	271	0·84	240
2	0·90	250	3·32	2,345	1·82	770	1·65	645	0·95	265	0·84	240
3	1·23	391	4·10	3,320	1·88	815	1·64	638	0·96	268	0·83	238
4	1·42	502	2·85	1,765	2·02	927	1·57	592	0·95	265	0·82	236
5	1·03	293	2·87	1,789	2·19	1,076	1·62	624	0·95	265	0·82	236
6	0·82	236	2·71	1,601	2·30	1,180	1·59	604	0·94	262	0·82	236
7	0·86	243	2·45	1,325	3·27	2,282	1·40	490	0·94	262	0·81	235
8	0·85	241	2·10	1,095	2·77	1,670	1·43	508	0·93	259	0·80	233
9	0·91	253	2·06	961	2·40	1,275	1·42	502	0·93	259	0·79	232
10	1·06	307	2·07	969	2·35	1,227	1·35	460	0·92	256	0·79	232
11	1·29	425	2·37	1,246	2·25	1,132	1·33	448	0·94	262	0·79	232
12	1·50	550	2·66	1,546	2·06	961	1·32	442	0·93	259	0·78	231
13	1·66	652	2·61	1,491	2·15	1,040	1·31	436	0·92	256	0·78	231
14	1·49	544	2·65	1,535	2·01	918	1·29	425	0·91	253	0·77	230
15	1·70	680	2·59	1,470	1·95	870	1·28	419	0·92	256	0·76	230
16	1·56	586	2·69	1,579	1·76	725	1·25	402	0·91	253	0·79	232
17	1·43	508	2·75	1,647	1·69	673	1·24	397	0·90	250	0·78	231
18	1·32	442	2·68	1,568	1·66	652	1·23	391	0·92	256	0·78	231
19	1·79	748	2·51	1,385	1·65	645	1·20	375	0·92	256	0·77	230
20	2·04	944	2·40	1,275	1·65	645	1·19	370	0·91	253	0·77	230
21	2·03	935	2·29	1,171	1·58	598	1·19	370	0·91	253	0·77	230
22	2·06	961	2·26	1,142	1·55	580	1·17	360	0·91	253	0·76	230
23	2·34	1,218	2·15	1,040	1·45	520	1·16	355	0·91	253	0·76	230
24	2·81	1,717	1·94	862	1·43	508	1·12	335	0·90	250	0·75	229
25	3·06	2,020	1·91	838	1·42	502	1·09	320	0·90	250	0·75	229
26	3·65	2,757	2·00	910	1·44	514	1·07	311	0·91	253	0·74	228
27	3·28	2,295	1·87	807	1·65	645	1·04	298	0·89	248	0·73	227
28	3·40	2,445	1·86	800	2·66	1,546	1·05	302	0·85	241	0·73	227
29	3·39	2,433	1·79	748	2·42	1,295	1·02	289	0·83	238	0·73	227
30	3·25	2,257	1·75	717	2·01	918	0·98	274	0·85	241	0·72	226
31	3·01	1,957	.....	.....	1·98	894	0·97	271	.....	.....	0·72	226

Monthly Discharge of Elbow River at Calgary, Alta., for 1908-1909.

(Drainage area, 466 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per Square Mile.	Depth in inches on Drainage Area.	Total in Acre-feet.
1908.						
May (8-31)	1,165	212	694·5	1·49	1·330	33,060
June	5,615	960	2,266·0	4·86	5·422	134,834
July	1,060	360	700·3	1·50	1·729	43,060
August	410	260	332·6	0·71	0·819	20,450
September	310	260	280·8	0·60	0·669	16,709
October	360	212	244·8	0·52	0·600	15,052
November (1-12)	360	212	236·5	0·50	0·223	5,629
The period	.....	.....	.....	.....	.....	268,794
1909.						
May	2,757	220	968·0	2·070	2·386	59,520
June	3,320	717	1,377·2	2·950	3·291	81,952
July	2,282	502	929·9	1·995	2·300	57,177
August	695	271	430·6	0·920	1·061	26,476
September	271	238	255·5	0·548	0·612	15,203
October	240	226	231·4	0·490	0·565	14,228
The period	.....	.....	.....	.....	.....	254,556

Discharge Measurements of Elbow River at Calgary, for 1910.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 11	J. C. Keith	135	306·5	1·06	1·04	325·39
May 27	do	139	371·05	1·48	1·50	548·04
June 15	do	136	350·95	1·28	1·33	450·55
July 11	do	135	298·70	0·925	0·965	276·27
Aug. 6	do	135	298·75	0·93	0·97	278·74
Aug. 26	do	134	284·25	0·825	0·86	234·87
Sept. 19	do	140	395·45	1·64	1·655	647·00
Oct. 6	H. R. Carscallen	106	316·05	1·03	1·06	326·97
Nov. 3	do	133	278·20	0·81	0·80	225·58
Nov. 24	do	104	255·25	0·385	0·84	98·29*†
Dec. 14	do	126	221·70	0·57	1·10	126·43*
Dec. 31	do	120	210·95	0·333	1·00	70·32*

*Ice conditions.
†Measurement taken at Bridge 400 yards down stream.

Daily Gauge Height and Discharge of Elbow River at Calgary, for 1910.

Day.	April.		May.		June.		July.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	·00	76	·55	160	1·10	336	1·21	387
2	·00	76	·54	158	1·36	468	1·20	382
3	·00	76	·53	156	1·30	434	1·18	372
4	·00	76	·53	156	1·25	107	1·15	358
5	·00	76	·59	170	1·18	372	1·08	328
6	·00	76	·61	174	1·15	358	1·05	315
7	·00	76	·70	196	1·13	349	1·03	307
8	·00	76	·82	230	1·35	462	1·02	302
9	·00	76	1·15	358	1·32	445	1·00	294
10	·00	76	1·17	368	1·35	462	·99	290
11	·00	76	1·13	349	1·34	456	·98	286
12	·00	76	1·12	345	1·65	650	·94	270
13	·00	76	1·07	323	1·55	582	·92	263
14	·00	76	1·05	315	1·46	526	·95	274
15	·01	77	1·01	298	1·35	462	·99	290
16	·09	87	·99	290	1·41	496	·99	290
17	·21	108	·98	286	1·57	596	·97	282
18	·26	110	·97	282	1·58	602	·97	282
19	·30	116	1·03	307	1·46	526	·98	286
20	·31	118	1·04	311	1·57	596	·96	278
21	·33	121	1·03	307	1·58	602	·93	267
22	·34	122	1·01	298	1·56	589	·92	263
23	·34	122	1·00	294	1·34	456	·90	256
24	·34	122	·99	290	1·28	423	·86	243
25	·35	124	1·21	387	1·20	382	·84	237
26	·39	130	1·58	602	1·17	368	·83	233
27	·43	137	1·54	576	1·23	397	·82	230
28	·47	144	1·35	462	1·22	392	·85	240
29	·56	162	1·26	412	1·22	392	·79	221
30	·57	165	1·15	358	1·22	392	·76	213
31			1·12	345			·73	204

Daily Gauge Height and Discharge of Elbow River at Calgary, for 1910. *Continued.*

Day.	August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	·72	202	·90	256	1·16	363	·82	230	1·24	161
2	·72	202	·86	243	1·13	349	·81	227	1·19	151
3	·71	199	·84	237	1·10	336	·80	224	1·21	154
4	·69	194	·89	253	1·12	345	·78	218	1·08	129
5	·79	221	·94	270	1·09	332	·76	213	1·06	126
6	·76	213	1·06	320	1·07	323	·75	210	1·01	117
7	1·01	298	1·22	392	1·03	307	·74	207	1·13	136
8	1·16	363	1·18	372	1·04	311	·73	204	1·07	126
9	1·13	349	1·12	345	1·04	311	·72	202	1·11	132
10	1·15	358	1·06	320	1·06	320	·71	199	1·05	120
11	1·26	412	1·15	358	1·05	315	1·07	323	·99	112
12	1·24	402	1·20	382	1·05	315	·85	240	1·01	114
13	1·18	372	1·25	407	1·04	311	·79	221	·97	107
14	1·17	368	1·25	407	1·03	307	·86	243	1·12	130
15	1·19	377	1·33	451	1·01	298	·85	240	1·16	134
16	1·13	349	1·46	526	·99	290	·84	237	1·32	160
17	1·10	336	1·54	576	·97	282	·78	218	1·17	130
18	1·05	315	1·65	650	1·01	299	*·75	210	1·14	123
19	1·00	294	1·66	657	·97	282	·94	240	1·21	132
20	·98	286	1·58	602	·95	274	·94	212	1·23	132
21	·95	274	1·54	576	·94	270	1·12	238	1·225	128
22	·94	270	1·45	520	·92	263	1·15	212	·90	80
23	·93	267	1·43	508	·91	260	1·00	116	·84	72
24	·93	267	1·41	496	·89	253	·97	116	1·145	110
25	·92	263	1·36	467	·88	250	·79	90	1·195	114
26	·87	246	1·31	440	·90	256	1·06	130	1·18	108
27	·84	237	1·28	423	·88	250	1·22	157	1·235	115
28	·79	221	1·27	418	·87	246	1·26	166	1·095	90
29	·85	240	1·24	402	·86	243	1·41	204	1·06	84
30	·86	243	1·20	382	·85	240	1·35	188	1·04	80
31	·95	274	.....	.....	·84	237	.....	.....	*1·095	82

*Ice conditions from November 18 to December 31.

Monthly Discharge of Elbow River at Calgary, for 1910.

(Drainage area, 482 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in Acre-Feet.
April	165	76	101	0·209	0·233	6,009
May	602	156	308·5	0·640	0·738	18,970
June	650	336	466	0·967	1·08	27,727
July	387	204	282	0·585	0·675	17,340
August	412	194	287·5	0·596	0·687	17,678
September	657	237	421·9	0·875	0·976	25,103
October	363	237	291·6	0·605	0·698	17,930
November	323	90	205·5	0·426	0·475	12,228
December	161	72	119	0·247	0·285	7,317
The period						150,302

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Discharge Measurements of Elbow River at Calgary, Alta., for 1911.

Date.	Hydrographer.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Jan. 5	H. R. Carscallen ..	120·0	182·1	0·53	1·10	64·0
Jan. 16	"	120·0	181·1	0·25	0·90	45·1†
Feb. 6	"	120·0	215·8	0·41	1·97	85·4†
Feb 18	"	100·0	204·0	0·54	2·22	111·0
Mar. 14	"	100·0	178·3	0·58	2·05	103·6†
Apr. 6	"	85·0	143·0	0·64	0·33	90·9†
Apr. 15	"	123·0	249·5	0·66	0·57	165·3
May 1	H. C. Ritchie	133·0	269·2	0·79	0·68	211·5
May 25	"	137·5	346·2	1·22	1·21	422·5
June 5	B. Russell	148·0	457·3	2·06	2·01	942·4
June 21	"	114·0	395·6	1·65	1·59	654·5
July 5	"	142·5	441·6	1·93	1·90	852·6
Aug. 3	H. T. Thomas	140·0	394·6	1·59	1·56	629·6
Aug. 9	H. Brown	159·5	675·1	3·67*	3·46	2,385·0
Aug. 23	"	139·0	410·8	1·67	1·65	686·4
Sept. 8	"	142·5	461·6	2·10	2·01	967·6
Sept. 25	"	135·5	347·8	1·3	1·33	453·1
Oct. 18	B. Russell	132·0	331·8	1·04	1·08	344·5
Nov. 21	N. McL. Sutherland	127·0	279·1	0·82	2·24*	229·1†
Dec. 6	"	115·0	241·2	0·40	2·30*	95·8†
Dec. 23	"	115·0	206·2	0·73	2·10*	151·1†

*New chain gauge †Ice conditions.

Daily Gauge Height and Discharge of Elbow River at Calgary, Alta., for 1911.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·06	71	1·78	73	2·30	128	0·55	80	0·71	209	2·61	1,466
2	0·99	65	1·79	74	2·26	123	0·45	79	0·78	201	2·51	1,37[illegible]
3	0·90	60	1·86	78	2·25	122	†0·42	82	0·66	196	2·37	1,244
4	0·87	54	1·89	79	2·25	123	0·38	84	0·64	190	2·25	1,139
5	1·09	64	1·96	85	2·26	125	0·51	102	0·73	215	2·09	1,006
6	1·12	64	2·00	88	2·23	121	0·47	105	0·73	215	1·83	807
7	1·25	69	1·95	84	2·26	126	0·60	147	0·74	218	1·74	743
8	1·34	71	2·03	91	2·25	125	0·49	143	0·78	230	1·69	708
9	1·19	63	1·99	87	2·21	121	0·47	152	0·76	224	1·65	682
10	†1·05	57	1·96	85	2·22	122	0·67	198	0·71	209	1·61	655
11	†0·90	51	1·98	86	2·17	116	0·63	188	0·71	209	1·78	771
12	0·76	48	2·02	90	2·09	107	0·89	267	0·68	201	1·99	926
13	0·79	47	2·03	91	2·14	114	0·89	236	0·78	230	2·21	1,105
14	0·74	45	2·00	88	2·18	107	0·67	198	1·02	319	2·17	1,071
15	0·99	48	2·07	95	2·08	116	0·69	203	0·98	302	2·09	1,006
16	0·90	45	2·03	91	2·09	128	0·79	233	1·18	392	2·02	950
17	1·01	47	2·10	98	1·96	118	0·92	278	1·97	911	1·97	911
18	1·59	64	2·21	110	1·92	123	0·87	269	1·75	750	1·85	821
19	1·59	64	2·16	104	1·86	124	0·84	250	1·59	641	1·70	715
20	1·61	64	2·10	98	1·82	128	0·98	302	1·41	520	1·65	682
21	1·68	68	2·12	101	2·26	255	1·30	458	1·36	495	1·59	641
22	1·69	68	2·23	115	1·97	191	1·43	539	1·32	470	1·58	635
23	1·72	70	2·27	120	1·92	199	1·17	388	1·33	477	1·67	695
24	1·69	68	2·19	111	1·81	192	1·16	383	1·29	452	1·76	757
25	1·68	68	2·16	108	1·81	203	1·10	354	1·28	447	2·40	1,270
26	1·75	72	2·20	113	1·70	193	1·06	336	1·25	430	1·99	926
27	1·64	66	2·23	119	1·60	185	0·99	306	1·22	413	1·95	895
28	1·74	71	2·27	123	1·55	189	0·89	267	1·22	413	2·00	934
29	1·75	72		..	1·40	170	0·80	236	1·43	539	2·02	950
30	1·76	72		.....	0·90	90	0·73	215	1·86	829	2·05	974
31	1·78	73			0·69	86			2·16	1,063		..

Daily Gauge Height and Discharge of Elbow River at Calgary, Alta., for 1911.—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·33	1,208	1·25	430	1·50	583	1·30	458	0·95	290	2·08	87
2	2·31	1,191	1·55	615	1·47	564	1·29	452	0·93	282	2·07	70
3	2·10	1,014	1·60	648	1·45	552	1·32	470	0·92	278	2·15	91
4	1·99	926	1·80	785	2·69	1,546	1·30	458	0·92	278	2·10	75
5	1·88	843	1·89	851	2·40	1,270	1·29	452	0·90	270	2·11	70
6	1·75	750	1·90	858	2·25	1,139	1·28	447	0·84	250	2·28	92
7	1·70	715	2·31	1,191	2·16	1,063	1·26	436	0·80	236	2·16	76
8	1·64	675	4·05	3,159	2·08	998	1·24	424	0·49	157	2·07	75
9	1·61	655	3·35	2,252	1·99	926	1·21	408	0·14	103	2·05	64
10	1·55	615	2·91	1,769	1·93	881	1·18	392	‡	85	2·16	90
11	1·48	570	2·69	1,546	1·89	851	1·14	373	‡	75	2·28	129
12	1·42	533	2·41	1,279	1·84	814	1·13	368	‡	80	2·35	146
13	1·35	489	2·30	1,182	1·77	764	1·12	364	‡	100	2·20	114
14	1·31	464	2·15	1,055	1·68	702	1·11	359	2·02*	120	2·06	85
15	1·33	477	2·00	934	1·61	655	1·10	354	2·15	183	2·05	89
16	1·38	508	2·18	1,080	1·56	622	1·10	354	2·46	377	2·07	97
17	1·35	489	1·93	881	1·55	615	1·08	345	2·34	293	2·35	196
18	1·33	477	1·78	771	1·48	570	1·06	336	2·35	300	2·20	150
19	1·51	590	1·67	695	1·43	539	1·05	332	2·36	307	1·91	61
20	1·47	564	1·91	866	1·41	526	1·05	332	2·37	314	2·10	130
21	1·41	526	1·75	750	1·38	508	1·03	323	2·24	231	2·27	207
22	1·39	514	1·73	736	1·37	501	1·03	323	2·44	340	1·99	100
23	1·65	682	1·69	708	1·37	501	1·04	328	2·18	180	2·08	143
24	1·59	641	1·64	675	1·35	489	1·04	328	2·19	175	2·23	225
25	1·48	570	1·61	655	1·33	477	1·03	323	2·25	192	1·99	107
26	1·41	526	1·75	750	1·33	477	1·02	319	2·26	185	1·76	31
27	1·45	552	1·70	715	1·32	470	1·02	319	2·49	270	1·79	38
28	1·39	514	1·67	695	1·32	470	1·01	314	2·20	144	1·79	38
29	1·31	464	1·62	661	1·32	470	0·99	306	2·28	162	1·76	31
30	1·28	447	1·59	641	1·31	464	0·98	302	2·12	105	1·76	31
31	1·26	436	1·54	609	.....	.....	0·95	290	.....	.....	2·08	149

† No observation, gauge height interpolated. ‡ Water below zero of gauge. Chain gauge installed.

Note.—Ice conditions during January, February, March, November and December. Daily discharges for those months are only approximate.

Monthly Discharge of Elbow River at Calgary, Alta., for 1911.

(Drainage area, 482 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per Square Mile.	Depth in inches on Drainage Area.	Total in Acre-feet.
January	73	45	62·2	0·129	0·15	3,824
February	123	73	95·9	0·199	0·21	5,326
March	255	86	141·0	0·293	0·34	8,670
April	539	79	236·0	0·490	0·55	14,043
May	1,063	190	407·0	0·844	0·97	25,025
June	1,466	635	915·0	1·898	2·12	54,446
July	1,208	436	633·0	1·313	1·51	38,922
August	3,159	430	982·0	2·037	2·35	60,381
September	1,546	464	700·0	1·452	1·62	41,653
October	470	290	367·0	0·761	0·88	22,566
November	377	75	212·0	0·440	0·49	12,615
December	225	31	100·0	0·207	0·24	6,149
The year	.....	.....	.....	.....	.....	293,620

Discharge Measurements of Elbow River at Calgary, for 1912.

Date.	Hydrographer.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Jan. 12	N. McL. Sutherland	125	180·75	0·51	1·96	92·3
Jan. 29	"	120	209·01	0·66	2·04	138·98
Feb. 12	"	118	194·7	0·66	2·00	129·4
Feb. 24	"	120	197·6	0·59	1·95	116·13
Mar. 8	"	105	171·2	0·51	1·84	88·0
Mar. 23	"	104	192·1	0·56	1·865	107·5
Apr. 4	"	130	316·5	1·14	2·40	361·47
May 2	H. C. Ritchie	136	347·8	1·38	2·47	481·14
May 6	F. R. Burfield	134	312·35	1·17	2·28	365·99
May 20	"	138·5	356·4	1·48	2·52	527·83
June 11	"	133	303·25	1·11	2·22	357·64
June 24	"	139	421·8	2·09	2·84	881·4
July 8	"	147	602·5	3·70	4·15	2,227·41
July 16	"	146	547·6	3·16	3·76	1,721·83
July 26	H. O. Brown	149	651·4	3·79	4·305	2,470·59
July 31	F. R. Burfield	143	435·4	2·23	3·00	972·72
Aug. 10	"	137	353·35	1·60	2·51	564·86
Aug. 24	"	143	334·2	1·44	2·35	480·41
Sept. 7	"	136	320·15	1·32	2·32	421·32
Sept. 24	"	137	320·4	1·25	2·32	400·30
Oct. 7	"	135·5	286·57	1·05	2·16	300·18
Oct. 22	"	135	298·0	1·10	2·13	326·00
Nov. 2	"	133·5	295·0	0·98	2·10	290·50
Nov. 15	"	129	251·0	0·72	1·91	180·40
Dec. 16	"	127	208·4	0·59	1·97	123·00

Daily Gauge Height and Discharge of Elbow River at Calgary, for 1912.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·99	126	2·01	132	1·94	113	2·28	305	2·70	540	2·31	412
2	1·95	116	2·00	129	1·76	67	2·33	330	†2·47	480	2·26	377
3	1·69	51	2·10	155	1·95	116	2·46	370	2·44	460	2·17	317
4	1·62	34	*2·46	150	1·75	65	2·38	365	2·41	440	2·19	329
5	1·66	43	2·03	137	1·84	87	2·64	300	2·38	420	2·15	305
6	1·75	65	1·97	121	1·92	108	2·05	190	2·20	335	2·14	299
7	1·72	58	1·96	119	1·83	85	2·03	180	2·25	370	2·14	299
8	1·68	48	1·97	121	1·86	93	2·13	230	2·29	398	2·15	305
9	1·74	53	1·96	119	1·94	113	2·15	245	2·34	433	2·14	299
10	1·79	75	1·98	124	1·95	116	2·19	265	2·25	370	2·14	299
11	1·88	198	1·98	124	1·95	116	2·14	245	2·20	335	2·21	342
12	1·96	119	1·97	121	1·95	116	2·01	185	2·11	281	2·21	342
13	1·96	119	1·97	121	1·97	121	2·04	205	2·06	255	2·17	317
14	1·96	119	1·97	121	1·93	111	2·05	210	2·16	311	2·46	520
15	1·99	126	*2·25	120	1·94	113	2·40	400	2·20	335	3·26	1,207
16	2·02	134	1·96	119	1·99	126	2·37	390	2·47	528	5·36	4,312
17	1·99	126	1·96	119	2·16	171	2·35	375	2·50	550	4·88	3,460
18	2·00	129	*2·73	121	2·03	137	2·30	350	2·50	550	4·56	2,918
19	2·04	139	1·98	124	1·91	106	2·20	295	2·49	542	4·01	2,024
20	1·99	126	1·93	111	1·91	106	2·09	230	2·49	542	3·59	1,535
21	1·95	116	1·94	113	1·86	93	2·08	225	2·45	512	3·36	1,305
22	1·96	119	1·94	113	1·86	93	2·06	220	2·49	542	3·10	1,060
23	1·95	116	1·95	116	†1·95	116	2·05	215	2·54	582	2·94	916
24	1·98	124	1·94	113	1·96	130	2·06	220	2·53	574	2·79	786
25	1·98	124	*2·42	110	1·96	150	2·05	215	2·44	505	2·72	727
26	2·00	129	1·90	103	1·96	165	2·04	210	2·39	468	2·70	710
27	2·01	132	1·91	106	1·97	175	2·04	210	2·53	574	2·59	622
28	2·01	132	1·91	106	2·00	190	2·01	200	2·55	590	2·51	558
29	2·01	132	1·89	100	2·02	210	2·06	222	2·46	520	2·47	528
30	2·00	129	.....	.....	1·98	205	2·18	287	2·44	505	2·68	694
31	2·00	129	.....	.....	2·29	300	.....	.....	2·36	447	.....	.....

*Gauge heights were taken at a different time of day. Mean daily discharge is about that given. †Changing conditions.

Daily Gauge Height and Discharge of Elbow River at Calgary, for 1912.—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·60	630	2·85	838	2·35	410	2·18	323	2·15	*168	1·88	98
2	2·58	614	2·75	752	2·33	426	2·17	317	2·14	165	1·85	90
3	2·61	638	2·74	744	2·32	419	2·16	311	2·13	163	1·94	113
4	2·76	761	2·64	662	2·36	447	2·15	305	2·13	163	1·96	119
5	2·68	694	2·61	638	2·44	505	2·14	299	2·12	160	1·93	110
6	3·01	979	2·57	606	2·29	398	2·17	317	2·11	158	1·94	113
7	3·36	1,305	2·54	582	2·32	419	2·16	311	2·10	155	1·98	124
8	3·66	1,611	2·54	582	2·40	475	2·16	311	2·11	158	2·06	144
9	4·61	3,008	2·49	542	2·41	482	2·26	377	2·12	160	2·03	136
10	4·46	2,742	2·45	512	2·48	535	2·23	356	2·12	160	2·06	144
11	4·28	2,437	2·57	606	2·34	433	2·20	335	2·11	158	2·03	136
12	4·16	2,245	2·50	550	2·30	405	2·19	329	2·11	158	2·00	129
13	4·20	2,305	2·46	520	2·26	377	2·24	363	2·10	155	1·99	126
14	4·56	2,918	2·41	482	2·27	384	2·25	370	2·12	160	2·01	132
15	4·17	2,260	2·33	426	2·28	391	2·27	384	2·10	155	2·24	191
16	3·75	1,710	2·38	461	2·25	370	2·27	387	2·10	155	1·97	121
17	3·48	1,425	2·54	582	2·25	370	2·30	405	2·07	147	1·82	82
18	3·26	1,207	2·57	606	2·24	363	2·33	426	2·06	144	1·80	77
19	3·10	1,060	2·52	566	2·21	342	2·26	377	2·13	163	1·79	74
20	3·12	1,078	2·46	520	2·20	335	2·23	356	2·05	142	1·81	80
21	3·17	1,123	2·44	505	2·19	329	2·25	370	2·04	139	1·80	77
22	3·04	1,006	2·37	454	2·31	412	2·11	281	2·06	144	2·10	155
23	3·32	1,265	2·33	426	2·33	426	2·15	305	2·05	142	2·06	146
24	4·10	2,155	2·31	412	2·31	412	2·14	239	2·05	142	2·11	158
25	5·01	3,690	2·41	482	2·30	405	2·14	299	2·02	134	2·14	165
26	4·28	2,437	2·45	512	2·29	398	2·16	311	2·02	134	2·09	152
27	3·73	1,688	2·40	475	2·26	377	2·14	299	2·04	139	2·01	132
28	3·32	1,265	2·53	574	2·23	356	2·14	299	2·03	137	1·95	116
29	3·15	1,105	2·58	614	2·21	342	2·12	287	1·99	126	1·91	106
30	3·01	979	2·46	520	2·18	323	2·14	299	1·94	113	1·71	56
31	2·94	916	2·35	440	...	.....	2·13	293	..	.	1·68	48

* Ice conditions after Nov. 1.

Monthly Discharge of Elbow River at Calgary, for 1912.

(Drainage area, 482 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per Square Mile.	Depth in inches on Drainage Area.	Total in Acre-feet.
January	139·0	34·0	106·3	0·22	0·25	6,536
February	155·0	100·0	120·2	0·25	0·27	6,914
March	300·0	65·0	129·4	0·27	0·31	7,956
April	400·0	180·0	263·0	0·54	0·60	15,650
May	590·0	255·0	461·0	0·96	1·11	28,346
June	4,312·0	299·0	937·0	1·94	2·16	55,755
July	3,690·0	614·0	1,588·9	3·30	3·81	97,202
August	838·0	412·0	554·5	1·15	1·33	34,095
September	535·0	323·0	403·2	0·84	0·93	23,992
October	426·0	281·0	332·2	0·69	0·79	20,426
November	168·0	113·0	149·9	0·31	0·35	8,820
December	191·0	48·0	117·7	0·24	0·28	7,237
The year	.....	.....	.....	.....	12·19	312,929

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Miscellaneous Discharge Measurements of tributaries of Bow River, by J. C. Keith, in 1909.

Date.	Stream.	Locality.	Width.	Area of section.	Discharge.
			Feet.	Sq.-ft.	Sec.-ft.
September 9	Bighill Creek	Sec. 10-26-1-5	10	5·75	6·4
September 9	Horse Creek	Sec. 8-26-4-5			Dry.
September 9	Grand Valley Creek	Sec. 24-26-5-5	7·8	3·04	0·80
September 9	Beaupre Creek	Sec. 15-26-5-5			Dry.
September 9	Spencer Creek	Sec. 17-26-5-5	8·	2·17	1·88
September 9	Ghost River	Sec. 24-26-6-5	70·	153·	393·
September 9	Jacob Creek	On Stony Indian Reserve, near mouth			Dry.
September 10	Cripple Creek	On Stony Indian Reserve, near mouth	4	1·29	0·73
September 10	Oldfort Creek	On Stony Indian Reserve, near mouth	11·6	6·06	10·57

MISCELLANEOUS MEASUREMENTS.

Miscellaneous Discharge Measurements of Nose Creek, near Calgary, Alta., in 1909.

Date.	Hydrographer.	Locality.	Width.	Area of section.	Discharge.
			Feet.	Sq.-ft.	Sec.-ft.
July 19	J. C. Keith	N. W. 13-24-1-5	19	15·8	23·4
September 2	do	do	9	4·0	5·8
September 18	do	do	9·3	4·2	5·7

Miscellaneous Discharge Measurements of Bow River, in 1909.

Date.	Hydrographer.	Locality.	Width.	Area of section.	Discharge.
			Feet.	Sq.-ft.	Sec.-ft.
September 8	J. C. Keith	Road allowance E. of sec. 34-25-4-5	305	813	1,017
September 10	do	Morley bridge on Stony Indian Reserve	178·5	966	3,390
October 20	P. M. Sauder	Intake S.A.L.Co., S.E. 31-21-25-4	336	887	2,874

Discharge Measurements of Nose Creek, near Calgary, in 1911.

Date.	Hydrographer.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 5	H. C. Ritchie	16·0	5·8	1·08	1·59	6·2
May 17	do	24·5	31·9	1·65	2·00	52·9
May 29	do	23·5	25·2	1·32	1·85	33·2
June 8	B. Russell	22·5	21·7	0·80	1·75	17·4
July 5	do	18·9	14·6	0·44	1·65	6·4
Aug. 2	H. T. Thomas	14·6	7·9	0·66	1·56	5·2
Aug. 24	H. Brown	16·1	9·7	0·91	1·66	8·8
Sept. 13	do	16·3	10·7	0·63	1·65	6·7
Sept. 27	do	16·9	44·5	0·21	1·67	9·3

Daily Gauge Height and Discharge of Nose Creek, near Calgary, Alta., for 1911.

Day.	April.		May.		June.		July.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	1·62	7·2	1·74	16·2	1·75	17·4
2	.....	.....	1·64	7·9	1·70	11·5	1·73	15·0
3	.....	.....	1·60	6·5	1·75	17·4	1·65	8·3
4	.....	.....	1·62	7·2	1·76	18·6	1·65	8·3
5	.....	.....	1·60	6·5	1·70	11·5	1·60	6·5
6	.....	.....	1·70	11·5	1·68	10·2	1·62	7·2
7	.....	.....	1·71	12·7	1·70	11·5	1·60	6·5
8	.....	.....	1·65	8·3	1·76	18·6	1·58	5·9
9	.....	.....	1·68	10·2	1·75	17·4	1·63	7·6
10	.....	.....	1·63	7·6	1·73	15·0	1·67	9·6
11	.....	.....	1·63	7·6	1·69	10·9	1·70	11·5
12	.....	.....	1·65	8·3	1·65	8·3	1·66	8·9
13	.....	.....	1·76	18·6	1·68	10·2	1·70	11·5
14	.....	.....	1·80	23·6	2·35	110·0	1·68	10·2
15	.....	.....	1·75	17·4	2·30	102·0	1·63	7·6
16	.....	.....	1·80	23·6	2·15	77·2	1·57	5·7
17	.....	.....	2·20	85·3	1·89	36·2	1·59	6·2
18	.....	.....	2·10	69·1	1·90	37·6	1·63	7·6
19	.....	.....	1·90	37·6	1·75	17·4	1·68	10·2
20	.....	.....	1·80	23·6	1·65	8·3	1·71	12·7
21	.....	.....	1·82	26·3	1·63	7·6	1·68	10·2
22	.....	.....	1·73	15·0	1·60	6·5	1·65	8·3
23	.....	.....	1·80	23·6	1·63	7·6	1·70	11·5
24	1·75	17·4	1·85	30·4	2·00	52·9	1·67	9·6
25	1·78	21·1	1·70	11·5	2·32	105	1·65	8·3
26	1·73	15·0	1·68	10·2	2·25	93·5	1·63	7·6
27	1·68	10·2	1·79	22·4	1·80	23·6	1·60	6·5
28	1·65	8·3	1·88	34·7	1·73	15·0	1·60	6·5
29	1·65	8·3	1·83	27·7	1·73	15·0	1·59	6·2
30	1·60	6·5	1·77	19·9	1·75	17·4	1·58	5·9
31	.....	.....	1·75	17·4	.....	.....	1·58	5·9

Daily Gauge Height and Discharge of Nose Creek, near Calgary, Alta., for 1911.—*Continued.*

Day.	August.		September.		October.		November.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·60	6·5	1·65	8·3	1·65	8·3	1·58	5·9
2	1·60	6·5	1·65	8·3	1·66	8·9	1·58	5·9
3	1·60	6·5	1·66	8·9	1·66	8·9	1·59	6·2
4	1·64	7·9	1·75	17·4	1·67	9·6	1·60	6·5
5	1·70	11·5	1·75	17·4	1·66	8·9	1·58	5·9
6	1·68	10·2	1·70	11·5	1·66	8·9	1·58	5·9
7	1·72	13·9	1·69	10·9	1·65	8·3	1·57	5·7
8	1·85	30·4	1·67	9·6	1·65	8·3	1·57	5·7
9	1·93	42·1	1·65	8·3	1·65	8·3	1·57	5·7
10	1·79	22·4	1·67	9·6	1·65	8·3	1·57	5·7
11	1·78	21·1	1·67	9·6	1·65	8·3	1·57	5·7
12	1·75	17·4	1·68	10·2	1·64	7·9	1·57	5·7
13	1·66	8·9	1·68	10·2	1·63	7·6	1·57	5·7
14	1·65	8·3	1·67	9·6	1·62	7·2	1·57	5·7
15	1·70	11·5	1·68	10·2	1·61	6·9	1·57	5·7
16	1·75	17·4	1·65	8·3	1·60	6·5	.....	.....
17	1·80	23·6	1·64	7·9	1·60	6·5	.....	.....
18	1·75	17·4	1·65	8·3	1·59	6·2	.....	.....
19	1·75	17·4	1·65	8·3	1·58	5·9	.....	.....
20	1·71	12·7	1·65	8·3	1·59	6·2	.....	.....
21	1·68	10·2	1·66	8·9	1·59	6·2	.....	.....
22	1·68	10·2	1·68	10·2	1·60	6·5	.....	.....
23	1·67	9·6	1·70	11·5	1·62	7·2	.....	.....
24	1·69	10·9	1·69	10·9	1·63	7·6	.....	.....
25	1·71	12·7	1·68	10·2	1·63	7·6	.....	.....
26	1·75	17·4	1·65	8·3	1·61	5·9	.....	.....
27	1·73	15·0	1·65	8·3	1·61	6·9	.....	.....
28	1·75	17·4	1·65	8·3	1·60	6·5	.....	.....
29	1·70	11·5	1·66	8·9	1·59	6·2	.....	.....
30	1·68	10·2	1·66	8·9	1·59	6·2	.....	.....
31	1·65	8·3	.....	.....	1·58	5·9	.....	.....

Monthly Discharge of Nose Creek, near Calgary, Alta., for 1911.

(Drainage area, 294 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage	Total in acre-feet.
April 24-30	21·1	6·5	12·4	0·042	0·01	172
May	85·3	6·5	20·6	0·070	0·08	1,267
June	110·0	6·5	30·3	0·103	0·12	1,803
July	17·4	5·7	8·7	0·030	0·03	535
August	42·1	6·5	14·4	0·049	0·06	885
September	17·4	7·9	9·8	0·033	0·04	583
October	9·6	5·9	7·4	0·025	0·03	455
November 1-15	6·5	5·7	5·8	0·020	0·01	173
The period	.....	.....	.....	.....	0·38	5,873

Discharge Measurements of Nose Creek, near Calgary, in 1912.

Date.	Hydrographer.	Width.	Area of section.	Mean Velocity.	Gauge Height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 4	H. C. Ritchie	23·5	28·95	1·98	2·04	57·26
May 8	F. R. Burfield	24	25·12	2·16	1·90	54·34
May 27	do	22·1	18·88	0·98	1·60	18·44
June 10	do	20	15·80	0·23	1·40	3·62
June 20	do	50·1	16·51	1·35	1·74	22·23
July 17	do	31·5	38·67	1·23	1·91	47·72
July 30	do	25	26·9	0·81	1·75	21·72
Aug. 9	do	21	15·95	0·64	1·66	10·25
Aug. 23	do	25	26·95	0·58	1·72	15·65
Sept. 7	do	25	31·65	2·12	2·04	66·97
Sept. 21	do	24	24·35	1·30	1·84	31·58
Oct. 5	do	23	23·20	1·11	1·87	25·67
Oct. 19	do	25	29·0	1·65	2·01	47·90
Oct. 30	do	24·5	25·6	1·19	1·92	30·50
Nov. 16	do	23	23·4	0·84	1·81	19·68

Note.—These gaugings were made at wading sections below gauge. Width, area, and mean velocity refer to actual gauging section.

Daily Gauge Height and Discharge of Nose Creek, near Calgary, for 1912.

Day.	March.		April.		May.		June.		July.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			2·10	69	1·95	45	1·58	15·1	1·70	15·5
2			2·00	53	1·95	45	1·58	14·9	1·74	19·9
3			2·15	77	2·00	53	1·59	15·7	1·78	25
4			2·10	69	2·02	56	1·58	14·6	1·76	22
5			2·00	53	2·02	60	1·58	14·2	1·73	18·8
6			1·90	38	2·03	66	1·57	13·0	1·80	28
7			1·90	38	2·00	65	1·57	12·6	1·83	32
8			1·95	45	1·95	62	1·55	10·7	1·83	32
9			1·97	48	1·82	43	1·52	8·5	1·95	45*
10			1·95	45	1·85	47	1·50	8·0	2·09	65*
11			1·93	42	1·73	32	1·50	7·1	2·00	58*
12			1·85	30	1·70	28	1·52	7·4	1·93	49
13			1·90	38	1·67	25	1·52	7·0	2·13	82
14			1·85	30	1·62	19·7	1·60	10·5	2·20	82*
15			1·80	24	1·58	16·1	1·73	22	2·13	82
16			1·77	20	1·57	15·2	1·95	43*	2·00	60
17			1·75	17·4	1·58	16·1	2·23	75*	1·93	49
18			1·79	22	1·60	17·8	2·05	70	1·90	44
19			1·75	17·4	1·81	42	1·81	30	1·87	39
20			1·73	15·0	1·85	47	1·73	18·8	2·06	70
21			1·73	15·0	1·92	57	1·70	15·5	2·05	68
22			1·70	11·5	1·83	44	1·68	13·9	1·95	52
23			1·70	11·5	1·80	40	1·64	10·9	1·94	50
24			1·68	10·1	1·78	38	1·61	9·1	1·90	44
25			1·68	10·1	1·78	38	1·60	8·5	2·22	80*
26	2·20	85	1·65	8·3	1·70	28	1·58	7·5	1·92	46
27	2·25	94	1·63	7·6	1·68	26	1·63	10·3	1·84	34
28	2·20	85	1·63	7·6	1·68	25	1·60	8·5	1·82	31
29	2·00	53	1·60	6·5	1·66	23	1·62	9·7	1·80	28
30	2·12	72	1·73	15·0	1·63	20	1·65	11·5	1·75	21
31	2·15	77			1·60	17			1·74	19 9

Note.—Shifting conditions May 4 to May 8, and May 27 to June 20.
*Bow River backing up to gauge. Discharge estimated.

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Daily Gauge Height and Discharge of Nose Creek, near Calgary, for 1912.

Day.	August.		September.		October		November	
	Gauge Height.	Discharge.	Gauge Height	Discharge.	Gauge Height.	Discharge.	Gauge Height	Discharge.
	Feet.	Sec. ft.	Feet	Feet	Gauge	Sec.-ft.	Feet.	Sec. ft.
1.	1·72	17·7	2·10	77	1·87	30	1·78	17·4
2.	1·70	15·5	2·10	77	1·87	29	1·75	13·8
3.	1·68	13·9	2·12	80	1·86	27	1·70	12·1
4.	1·66	12·3	2·09	75	1·86	26	1·63	8·7
5.	1·70	15·5	2·05	68	1·86	25	1·68	11·0
6.	1·70	15·5	2·02	61	1·85	24	1·74	14·4
7.	1·69	14·7	2·05	68	1·85	24	1·86	25
8.	1·68	13·9	2·11	78	1·90	30	1·89	28
9.	1·67	13·1	2·14	83	1·94	35	1·83	22
10.	1·67	13·1	2·13	82	1·95	37	1·79	18·2
11.	1·72	17·7	2·09	75	1·99	43	1·73	13·8
12.	1·70	15·5	2·03	65	2·01	46	1·75	15·0
13.	1·70	15·5	2·02	64	2·02	48	1·80	19·0
14.	1·70	15·5	1·98	57	2·04	51	1·83	22
15.	1·70	15·5	1·95	52	2·03	52	1·83	22
16.	1·74	19·9	1·93	49	2·04	51		
17.	1·85	36	1·89	42	2·02	48		
18.	1·90	44	1·86	37	2·04	51		
19.	1·88	40	1·86	37	2·00	44		
20.	1·85	36	1·85	36	1·96	38		
21.	1·75	21	1·85	36	1·93	34		
22.	1·72	17·7	1·86	37	1·90	30		
23.	1·74	19·9	1·88	39	1·85	24		
24.	1·77	24	1·94	48	1·82	21		
25.	1·85	36	1·93	45	1·80	19·0		
26.	1·83	32	1·92	43	1·78	17·4		
27.	1·88	40	1·91	40	1·78	17·4		
28.	1·80	42	1·90	38	1·79	18·2		
29.	2·31	62	1·88	34	1·81	19·9		
30.	2·13	82	1·87	31	1·80	19·0		
31.	2·11	78			1·78	17·4		

Note.—Shifting conditions Sept. 21 to Oct. 5.

Monthly Discharge of Nose Creek, near Calgary, for 1912.

(Drainage area, 284 square miles).

Month	Discharge in Second-Feet			Run-Off	
	Maximum.	Minimum.	Mean.	Per Square Mile	Depth in inches on Drainage Area	Total in Acre-feet.
March (26-31)	94	53	77·7	0·264	0·06	925
April	77	6·5	29·8	0·101	0·11	1,773
May	66	15·2	37·3	0·127	0·15	2,294
June	75	7·0	17·5	0·060	0·07	1,041
July	82	15·5	44·9	0·153	0·18	2,761
August	82	12·3	27·6	0·094	0·11	1,697
September	83	31	55·2	0·188	0·21	3,285
October	52	17·4	32·1	0·109	0·13	1,974
November (1-15)	28	8·7	17·5	0·060	0·03	521
The period					1·05	16,271

Daily Gauge Height and Discharge of Canadian Pacific Railway Company's Canal near Calgary, Alta., for 1909.

Day.	May.		June.		July.		August.		September.		October.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	2·10	86	2·00	73	3·50	320	1·50	24	3·20	266
2	.....	.....	2·10	86	2·00	73	3·50	320	3·50	320	3·20	266
3	0·00	00	2·10	86	1·50	24	3·50	320	3·50	320	3·20	266
4	1·80	50	2·10	86	1·50	24	3·40	302	4·10	430	2·10	86
5	1·90	61	2·10	86	1·40	17	3·40	302	4·30	468	2·10	86
6	2·70	179	2·10	86	1·30	12	3·40	302	4·10	430	2·10	86
7	2·70	179	2·10	86	1·60	31	3·40	302	1·90	61	2·10	86
8	2·80	196	2·70	179	1·90	61	3·40	302	1·10	3	2·10	86
9	2·80	196	2·80	196	1·90	61	3·50	320	3·20	266	2·10	86
10	2·90	213	2·80	196	1·90	61	3·60	338	3·20	266	1·80	50
11	3·10	248	2·50	146	1·90	61	3·60	338	3·50	320	1·40	17
12	3·10	248	2·40	130	1·80	50	3·60	338	3·00	230	1·30	12
13	3·20	266	2·00	73	1·80	50	3·60	338	2·80	196	1·20	7
14	3·40	302	1·80	50	1·80	50	3·60	338	3·10	248	1·20	7
15	2·40	130	1·60	31	1·80	50	3·60	338	3·20	266	1·20	7
16	2·30	114	1·50	24	2·10	86	3·60	338	3·00	230	1·20	7
17	2·20	99	1·50	24	2·10	86	3·60	338	3·20	266	1·20	7
18	2·10	86	1·50	24	2·00	73	3·50	320	3·00	230	1·20	7
19	2·20	99	1·50	24	2·20	99	3·50	320	3·20	266	1·00	1
20	2·30	114	1·50	24	2·70	179	3·20	266	3·20	266	1·00	1
21	2·30	114	1·50	24	3·50	320	3·20	266	3·20	266	1·00	1
22	2·30	114	1·50	24	3·50	320	2·90	213	2·90	213	1·00	1
23	2·30	114	1·50	24	3·50	320	3·20	266	1·60	31	0·90	0
24	2·00	73	1·50	24	3·50	320	3·50	320	2·30	114	0·90	0
25	2·00	73	2·10	86	3·50	320	3·50	320	3·20	266	0·90	0
26	2·00	73	3·30	284	3·50	320	3·50	320	3·20	266	0·90	0
27	2·10	86	3·20	266	3·50	320	3·50	320	3·20	266	0·80	0
28	2·10	86	1·90	61	3·60	338	3·50	320	2·60	162	0·80	0
29	2·10	86	1·70	40	3·70	356	2·90	213	2·40	130	0·80	0
30	2·10	86	1·70	40	3·80	374	1·50	24	1·70	40	0·80	0
31	2·10	86	.....	.....	3·50	320	1·50	24	.....	.....	0·80	0

Discharge Measurements of Canadian Pacific Railway Company's Canal near Calgary, Alta., in 1908-1909.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1908.		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 12	H. R. Carscallen	49·5	84	0·74	2·19	63
July 22	do	46·5	60	0·27	1·625	16
September 2	do	46·5	62	0·26	1·64	15·8
October 1	H. C. Ritchie	52·0	103	0·95	2·45	98
1909.						
June 11	P. M. Sauder	51·5	111	1·27	2·47	141
June 25	J. C. Keith	45·0	62	0·36	1·47	22
July 3	do	48·0	84	0·82	1·975	69
July 17	do	50·0	97	0·98	2·20	96
August 6	do	56·0	159	1·89	3·40	301
August 30	do	56·5	165	1·92	3·48	318
September 18	do	55·5	175	1·94	3·70	341

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Daily Gauge Height and Discharge of Canadian Pacific Railway Company's Canal near Calgary, Alta., for 1908.

Day.	May.		June.		July.		August.		September.		October.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	2·30	86	4·00	376	3·10	213	3·00	196	2·50	114
2	.....	.....	2·30	86	4·10	395	3·10	213	1·70	23	1·40	5
3	.....	.....	1·40	5	4·20	414	3·10	213	1·60	16	2·50	114
4	.....	.....	1·10	0	4·20	414	3·10	213	1·60	16	2·50	114
5	.....	.....	0·90	0	4·20	414	3·10	213	1·60	16	2·50	114
6	.....	.....	0·90	0	4·10	395	3·10	213	2·60	129	1·40	5
7	.....	.....	0·90	0	4·10	395	3·10	213	2·60	129	1·00	0
8	2·50	114	0·90	0	4·10	395	3·10	213	2·70	144	2·50	114
9	2·50	114	0·90	0	4·10	395	3·10	213	2·40	100	3·60	302
10	2·20	73	0·90	0	2·90	178	3·10	213	1·50	10	3·40	266
11	2·20	73	0·90	0	1·70	23	3·10	213	1·50	10	3·40	266
12	2·20	73	0·80	0	1·40	5	3·10	213	1·80	31	3·40	266
13	2·20	73	0·80	0	1·40	5	3·10	213	1·90	40	3·40	266
14	2·20	73	0·90	0	1·30	2	3·10	213	2·10	61	3·40	266
15	2·20	73	0·90	0	1·20	1	3·10	213	2·80	161	3·50	284
16	2·20	73	0·90	0	1·20	1	3·10	213	2·00	50	3·60	302
17	2·20	73	0·90	0	1·10	0	3·10	213	1·40	5	3·60	302
18	2·20	73	0·90	0	1·10	0	3·10	213	1·00	0	3·60	302
19	2·20	73	0·90	0	2·60	129	3·00	196	1·50	10	2·50	114
20	2·30	86	0·90	0	2·60	129	3·00	196	1·40	5	1·50	10
21	2·20	73	0·90	0	2·60	129	3·00	196	1·60	16	1·50	10
22	2·20	73	0·90	0	2·20	73	2·90	178	1·60	16	1·00	0
23	2·20	73	2·20	73	3·90	357	3·00	196	1·80	31	0·90	0
24	2·20	73	2·80	161	3·90	357	3·00	196	1·80	31	0·80	0
25	2·20	73	2·90	178	3·90	357	3·10	213	1·90	40	0·80	0
26	2·20	73	3·00	196	3·40	266	3·10	213	2·50	114	0·80	0
27	2·20	73	3·00	196	3·30	248	3·00	196	2·50	114	0·80	0
28	2·20	73	3·00	196	3·30	248	3·00	196	2·50	114	0·80	0
29	2·20	73	3·00	196	3·20	231	3·00	196	2·50	114	0·80	0
30	2·20	73	3·90	357	3·20	231	3·00	196	2·50	114	0·80	0
31	2·20	73	.....	.....	3·20	231	3·00	196	.....	.....	0·80	0

Discharge Measurements of Canadian Pacific Railway Company's Canal near Calgary, in 1910.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 9	J. C. Keith	54·5	156·9	1·78	2·4	279·46
May 21	do	63·5	70·02	2·2	1·55	154·18
June 15	do	55·0	133·27	1·54	2·0	205·25
June 27	do	55·5	200·98	2·15	3·3	432·28
July 13	do	56·0	226·16	2·15	3·64	486·75
Aug. 8	do	56·0	220·78	2·226	3·6	491·5
Aug. 27	do	56·0	184·73	1·87	2·7	345·45
Sept. 10	do	55·5	150·32	1·54	2·245	231·7
Oct. 3	H. R. Carscallen	60·7	206·79	1·9	3·01	391·94
Oct. 14	do	11·0	5·48	0·651	0·45	3·57

Daily Gauge Height and Discharge of Canadian Pacific Railway Company's Canal near Calgary, for 1910.

Day.	April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	1·8	186	2·0	216
2	.....	.....	1·8	186	1·25	106
3	.....	.....	1·75	178	0·25	.....
4	.....	.....	1·7	171	0·65	28
5	.....	.....	1·7	171	1·3	113
6	.....	.....	1·7	171	1·6	156
7	.....	.....	1·75	178	1·7	171
8	.....	.....	1·9	201	1·7	171
9	.....	.....	2·35	271	1·7	171
10	.....	.....	2·4	279	1·7	171
11	.....	.....	1·65	163	1·8	186
12	.....	.....	1·6	156	2·05	224
13	.....	.....	1·5	141	2·1	231
14	.....	.....	1·5	141	2·1	231
15	.....	.....	1·5	141	2·0	216
16	.....	.....	1·5	141	2·7	328
17	.....	.....	1·5	141	2·7	328
18	.....	.....	1·5	141	0·0	.....
19	.....	.....	1·4	127	1·85	194
20	.....	.....	1·5	141	1·6	156
21	.....	.....	1·5	141	2·0	216
22	.....	.....	1·5	141	2·2	247
23	.....	.....	1·9	201	2·2	247
24	.....	.....	1·9	201	2·5	295
25	.....	.....	2·2	247	2·65	320
26	.....	.....	2·2	247	3·05	388
27	1·8	186	2·2	247	3·3	432
28	1·8	186	2·0	216	3·3	432
29	1·9	201	2·0	216	3·3	432
30	1·85	193	2·0	216	3·35	441
31	.....	.....	2·0	216	.....	.....

Daily Gauge Height and Discharge of Canadian Pacific Railway Company's Canal near Calgary, for 1910.—*Continued.*

Day.	July.		August.		September.		October.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	3·4	449	3·8	521	2·3	263	2·77	340
2	3·45	458	3·8	521	2·3	263	2·85	354
3	3·6	485	3·6	485	2·25	255	2·9	362
4	3·9	539	3·6	485	2·35	271	3·0	379
5	4·15	586	3·6	485	2·35	271	2·65	320
6	4·3	615	3·6	485	2·35	271	2·15	240
7	4·3	615	3·6	485	2·3	263	1·62	159
8	4·3	615	3·6	485	2·3	263	·80	46
9	4·3	615	3·6	485	2·3	263	·55	17
10	4·3	615	3·6	485	2·3	263	·35	*
11	4·0	558	3·09	395	2·35	271		
12	3·7	503	2·54	302	2·33	268		
13	3·7	503	2·53	300	1·65	164		
14	3·85	530	2·25	255	1·0	72		
15	4·3	615	2·25	255	1·0	72		
16	4·5	653	2·2	247	·92	62		
17	4·35	625	2·0	216	·93	63		
18	4·3	615	2·15	240	·95	66		
19	3·8	521	2·3	263	1·8	186		
20	3·7	503	2·25	255	2·52	299		
21	3·7	503	2·2	247	2·38	276		
22	3·7	503	2·2	247	2·5	295		
23	3·6	185	2·35	271	2·0	216		
24	3·8	521	2·6	312	2·0	216		
25	4·05	567	2·65	320	2·0	216		
26	4·0	558	2·7	328	2·0	216		
27	4·1	577	3·05	388	1·97	212		
28	4·05	567	3·5	467	1·95	209		
29	4·0	558	3·0	379	2·35	271		
30	3·8	521	3·0	379	2·75	337		
31	3·8	521	3·0	379				

* Canal closed for the season.

Monthly Discharge of Canadian Pacific Railway Company's Canal near Calgary, for 1910.

Month.	Discharge in Second-Feet.			Total Discharge in acre feet
	Maximum.	Minimum.	Mean.	
April (27–30)	201	186	191·5	1,519
May	297	141	184·3	11,333
June	432		228·2	13,578
July	653	449	551·6	33,918
August	521	216	366·7	22,547
September	337	62	221·1	12,055
October (1–10)	379		221·7	4,396
The period				99,346

Discharge Measurements of Canadian Pacific Railway Company's Canal near Calgary, Alta., for 1911.

Date.	Hydrographer.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Apr. 17	H. C. Ritchie	63·0	57·9	2·35	....	136·3*
May 5	do	64·5	85·8	2·47	....	212·1*
May 18	do	44·5	45·6	1·26	1·87	57·6
June 6	B. Russell	53·0	87·3	1·84	2·60	161·1
July 10	do	59·5	190·4	2·11	3·75	401·5‡
Aug. 4	H. T. Thomas	56·4	101·2	1·44	2·60	145·3‡
Aug. 24	H. Brown	46·5	55·8	1·27	2·00	70·8
Sept. 13	do	56·2	125·3	2·30	3·29	288·8
Sept. 22	L. R. Brereton	50·0	75·8	1·61	2·40	122·3

* Gauging made at a wading section near the intake. Water was turned into the canal for a few days in April to fill the pool in the canal.

‡ Gauging made at a bridge (No. 1.) on the north side of Sec. 36, Tp. 23, Rge. 1, W. 5th Mer.

Daily Gauge Height and Discharge of Canadian Pacific Railway Company's Canal near Calgary, Alta., for 1911.

Day.	April.		May.		June.		July.		August.		September.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			2·10	83	2·40	122	3·15	259	2·60	154	2·25	101
2			2·40	122	2·43	127	3·15	259	2·60	154	2·30	108
3			3·10	248	2·47	*133	3·15	259	2·60	154	2·35	115
4			3·00	228	2·87	†202	3·15	259	2·60	154	2·80	415
5			3·00	228	2·57	149	3·15	259	2·60	154	3·90	441
6			3·00	228	2·57	149	3·15	259	2·75	180	3·90	441
7			3·00	228	2·57	149	3·10	248	2·85	198	3·85	428
8			3·00	228	2·57	149	3·00	228	2·80	189	3·50	340
9			3·00	228	2·52	141	3·00	228	2·80	189	2·90	208
10			3·00	228	2·50	138	3·75	402	2·75	180	2·85	198
11			3·00	228	2·58	151	3·85	428	2·75	180	2·85	198
12			2·80	189	2·56	148	3·60	361	2·75	180	2·85	198
13			2·60	154	2·70	171	3·60	364	2·80	189	3·10	248
14			2·70	171	2·90	208	3·40	316	2·90	208	3·15	259
15			2·55	146	2·95	218	3·40	316	2·80	189	3·15	259
16			2·15	130	2·95	218	3·40	316	2·60	154	3·00	228
17			2·25	101	3·55	253	3·45	328	2·50	138	2·85	198
18			2·15	89	3·53	347	3·45	328	2·50	138	2·85	198
19			1·70	43	3·53	347	3·45	328	2·50	138	2·85	198
20			2·65	162	3·80	415	3·45	328	2·50	138	2·80	189*
21			2·60	154	3·80	415	3·45	328	2·50	138	2·50	138
22			2·60	154	3·95	454	3·00	228	2·45	130	2·40	122
23			2·25	101	3·95	454	3·00	228	2·45	130	2·40	122
24			2·20	95	4·00	467	3·00	228	2·25	101	2·40	122
25			2·20	95	3·45	328	2·95	218	2·20	95	2·40	122
26			2·20	95	3·45	328	2·90	208	2·20	95	3·80	415x
27			2·22	97	3·45	328	2·70	171	2·20	95	3·85	428x
28			2·20	95	3·45	328	2·70	171	2·20	95	0·75	0·00
29			2·20	95	3·20	270	2·70	171	2·00	71	.....	.....
30	1·65	39	2·20	95	3·20	270	2·60	154	2·00	71	.....	.....
31			2·30	108	.....	.....	2·60	154	2·00	71	.....	.....

*Opened one gate at 7·00 p.m.

†Closed one gate at 8·30 p.m.

xWater shut off at intake for the season.

Note—Water was turned into the canal for a few days about the middle of April to fill the pool in the canal. Canal was opened for the irrigation season on April 30. Gauge heights from April 30 to May 17 were interpolated from observations made at bridge No. 2.

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Monthly Discharge of Canadian Pacific Railway Company's Canal near Calgary, Alta., for 1911.

Month.	Discharge in Second-Feet.			Total Discharge in acre-feet.
	Maximum.	Minimum.	Mean.	
April (30)	39	39	39	77
May	248	43	150	9,223
June	467	122	256	15,233
July	428	154	269	16,540
August	208	71	144	8,854
September (1-28)	441	0	230	12,774
The period (April 30 to Sept. 28)				62,701

Discharge Measurements of C.P.R. Main Canal "A" at Bridge No. 1, in 1912.

Date.	Hydrographer.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 4	H. C. Ritchie	49·5	79·5	1·03	2·06	81·85
May 8	F. R. Burfield	47·5	68·3	0·90	1·82	61·42
May 25	do	55·5	118·2	1·25	2·61	148·39
June 10	do	56·6	118·3	1·54	2·75	181·84
June 20	do	57·0	120·2	1·54	2·85	185·87
July 10	do	58·5	142·4	1·51	2·85	214.5
July 17	do	55·0	118·4	1·52	2·75	180·01
July 30	do	55·0	114·2	1·42	2·64	161·81
Aug. 9	do	54·5	113·2	1·47	2·66	166·02
Aug. 23	do	59·5	167·4	1·91	3·66	320·23
Sept. 7	do	53·5	106·4	1·33	2·50	141·16
Sept. 21	do	59·0	163·5	1·80	3·54	293·26
Oct. 5	do				1·10	Nil.

Discharge Measurements of C.P.R. Main Canal "A" at Bridge No. 3, in 1912.

Date.	Hydrographer.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
		Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 4	H. C. Ritchie	48·0	63·9	1·52		97·19
May 8	F. R. Burfield	42·5	42·3	0·96		39·76
May 25	do	50·0	92·8	1·82		168·60
June 10	do	52·5	96·8	2·03		196·88
June 20	do	52·3	102·4	2·03	2·97	208·26
July 10	do	53·0	121·9	1·91	3·02	233·35
July 17	do	53·5	101·7	1·94	2·85	197·59
July 30	do	53·0	95·8	1·89	2·75	171·26
Aug. 9	do	52·5	97·1	1·75	2·84	169·61
Aug. 23	do	56·9	150·9	2·22	3·77	335·59
Sept. 7	do	51·5	93·1	1·68	2·75	156·53
Sept. 21	do	55·5	142·0	2·05	3·58	291·51

Daily Gauge Height and Discharge of C.P.R. Main Canal "A" near Calgary, for 1912.

Day.	April.		May.		June.		July.		August.		September.	
	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Dls-charge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	....	3·20	247	2·65	167	3·10	232	2·50	146	2·40	132
2	.....	...	2·40	132	2·60	160	3·00	217	2·50	146	2·50	146
3	.....	...	2·40	132	2·65	167	2·90	202	2·50	146	2·50	146
4	.....	...	2·30	118	3·00	217	2·90	202	2·50	146	2·50	146
5	.....	...	1·90	71	3·00	217	3·00	217	2·60	160	2·50	146
6	.....	.....	1·90	71	2·90	202	2·90	202	2·60	160	2·50	146
7	.....	.....	1·70	51	2·90	202	2·90	202	2·60	160	2·50	146
8	.....	.....	2·10	94	2·80	188	3·00	217	2·50	146	2·50	146
9	.....	.....	2·10	94	2·90	202	2·90	202	2·50	146	2·50	146
10	.....	.....	2·30	118	2·70	174	2·80	188	2·60	160	2·70	174
11	.....	.....	2·30	118	3·15	240	2·70	174	3·00	217	3·30	262
12	.....	.....	2·40	132	3·20	247	2·70	174	3·00	217	4·00	368
13	.....	.....	2·40	132	3·20	247	2·70	174	3·00	217	3·00	217
14	.....	.....	2·50	146	3·40	277	2·70	174	3·00	217	2·80	188
15	.....	.....	2·70	174	3·20	247	2·70	174	3·00	217	2·90	202
16	.....	.....	2·70	174	3·10	232	2·70	174	3·30	262	2·90	202
17	.....	.....	2·70	174	2·70	174	2·70	174	3·30	262	3·00	217
18	.....	.....	2·50	146	2·70	174	2·75	181	3·30	262	3·30	262
19	.....	.....	2·50	146	2·70	174	2·70	174	3·30	262	3·50	292
20	.....	.....	2·40	132	2·60	160	2·75	181	3·30	262	3·50	292
21	.....	.....	2·40	132	2·60	160	2·50	146	3·10	232	3·50	292
22	.....	.....	2·50	146	2·80	188	2·50	146	3·10	232	3·50	292
23	2·00	* 82	2·50	146	3·10	232	2·50	146	3·30	262	3·50	292
24	2·20	106	2·50	146	3·70	322	2·50	146	3·10	232	3·30	262
25	1·80	61	2·50	146	4·00	368	2·80	188	3·10	232	3·20	247
26	2·50	146	2·50	146	4·10	384	2·70	174	2·90	202	3·10	232
27	2·50	146	2·60	160	4·10	384	2·60	160	2·80	188	3·10	232
28	3·00	217	2·65	167	3·60	307	2·60	160	2·10	94	1·85	† 66
29	3·00	217	2·65	167	3·10	232	2·50	146	2·10	94	.....	.....
30	3·00	217	2·60	160	3·10	232	2·50	146	2·10	94	.....	.....
31	.....	.....	2·65	167	.....	.....	2·60	160	2·10	94	.....	.....

*Headgates opened.
†Headgates closed.

Monthly Discharge of C.P.R. Main Canal "A" near Calgary, for 1912.

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per Square Mile.	Depth in inches on Drainage Area.	Total in Acre-feet.
April (23-30)	217	61	140	.....	.....	2,225
May	247	51	138	.....	.....	8,485
June	384	160	229	.....	.....	13,626
July	232	146	179	.....	.....	11,006
August	262	94	189	.....	.....	11,621
September (1-28)	368	66	210	.....	.....	11,662
The period	.....	.....	.....	.....	.....	58,625

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Daily Discharge of Bow River from records at Morley and Horseshoe Falls, 1910.

Day.	Jan.	Feb.	March.	April.	May.	June.
	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.
1		905*		757*		6,910
2		685*		861*		7,660
3		1,130*		710*		7,195
4		813*		815*		6,635
5		760*	949*	804*		6,115
6						6,500
7		1,648*		802*		7,830
8		795*	843*	805*		8,175
9		825*		837*		7,660
10		1,456*	790*	800*		7,660
11		907*	904*			9,070
12		765*	1,015*	860		12,475
13		802*	1,058*			12,680
14		639*		1,447*		10,640
15		699*	955*	1,262*		10,040
16		682*	875*	1,021*		11,245
17		738*	833*			11,860
18		755*				13,090
19		725*	755*			11,245
20				1,438*		11,245
21	971*	675*		1,738*		12,680
22			979*	1,761*		11,450
23			1,105*	1,701*		9,840
24			1,011*	1,910*		8,525
25			1,110*	2,760*	8,350	7,830
26			1,010*		10,240	8,700
27					10,440	9,840
28			914*		9,070	10,840
29			830*		7,660	10,840
30			786*		7,050	9,840
31	972*		812*		6,500	

*Discharge from records kept by the Calgary Power Co. at Horseshoe Falls.
The remainder are from records of the Irrigation Branch taken at Morley.

DAILY DISCHARGE of Bow River from records at Morley and Horseshoe Falls, 1910.—*Continued.*

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.
1	9,255	5,185	2,901	2,520	1,888	1,540*
2	9,440	5,070	2,816	2,490	1,930	1,583*
3	8,350	4,850	2,648	2,370	1,860	1,515*
4	8,175	4,740	2,799	2,370	1,930	1,430*
5	8,000	5,415	2,935	2,295	1,846	1,612*
6	8,000	6,500	3,115	2,220	1,874	1,617*
7	7,830	6,635	3,210	2,370	1,790	1,497*
8	8,000	6,500	3,077	2,520	2,322*	1,663*
9	8,175	6,115	2,765	2,445	2,267*	1,608*
10	7,830	6,115	2,680	2,680	2,283*	1,537*
11	7,830	5,875	2,731	2,850	2,284*	1,462*
12	8,175	5,875	2,568	2,935	2,238*	1,600*
13	8,700	5,760	2,552	2,765	2,230*	1,462*
14	9,255	5,645	2,475	2,799	2,010*	1,478*
15	9,255	5,530	2,475	2,600	2,070*	1,400*
16	9,640	5,300	2,520	2,600	2,038*	1,420*
17	9,070	4,960	2,731	2,850	1,765*	1,500*
18	9,440	4,740	2,765	2,986	1,765*	1,485*
19	8,885	4,630	2,850	2,884	1,788*	1,376*
20	8,175	4,410	2,935	2,748	1,902*	1,286*
21	7,830	4,410	2,901	2,680	2,063*	1,420*
22	7,660	4,305	3,020	2,600	1,920*	1,240*
23	7,340	4,200	3,096	2,520	1,877*	1,262*
24	7,050	4,095	2,901	2,430	1,837*	1,612*
25	6,240	3,685	3,020	2,445	1,500*	1,340*
26	6,370	3,485	2,969	2,370	1,315*	1,580*
27	5,990	3,305	2,765	2,265	1,340*	1,455*
28	5,760	3,305	2,600	2,160	1,373*	1,317*
29	5,990	3,115	2,536	2,070	1,382*	1,417*
30	5,921	2,986	2,460	2,000	1,400*	1,373*
31	5,990	2,952	.....	1,972	.....	1,904*

*Discharge from records of the Calgary Power Co., Horseshoe Falls. The remainder are Irrigation Branch records taken at Morley Bridge.

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Daily Discharge of Bow River from records at Morley and Horseshoe Falls, 1911.

Day.	Jan.	Feb.	March.	April.	May.	June.
	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.
1	823*	750*	710*	694	1,240	3,698*
2	823*	780*	710*	670	1,317	5,207*
3	862*	784*	730*	670	1,422	7,240*
4	1,117*	763*	720*	670	1,470	7,370*
5	1,360*	780*	722*	626*	1,720	6,839*
6	1,230	740*	722*	808	2,160	6,548*
7	1,310*	784*	788*	674	2,010	6,430*
8	1,243*	750*	775*	708	2,010	5,825*
9	770*	784*	775*	768	2,190*	5,960*
10	796*	818*	765*	768	1,815*	6,470*
11	935*	840*	740*	774	1,935	7,150*
12	.....	800*	740*	755	2,010	8,490*
13	.....	780*	735*	.....	2,085	10,443*
14	.....	784*	778*	755	2,010	12,375*
15	.....	780*	780*	790	1,935	13,043*
16	.....	710*	810*	776	2,240	13,189*
17	.....	725*	725*	790	1,940*	13,105*
18	.....	700*	800*	822	1,930*	12,695*
19	.....	730*	900*	790	2,120*	11,660*
20	.....	730*	855*	830	2,200*	11,660*
21	654	700*	830*	870	2,200*	11,475*
22	680	710*	902*	.....	2,140*	11,780*
23	646	600*	925*	950	2,150*	13,820*
24	590	680*	880*	1,262	2,120*	14,770*
25	586	690*	935*	942*	2,100*	12,925*
26	1,120*	720*	750*	1,100	2,120*	11,725*
27	1,345*	725*	750*	1,190	2,150*	11,994*
28	980*	720*	810*	1,140	2,337*	12,014*
29	940*	.....	880*	1,210	2,230*	11,700*
30	940*	.....	855*	1,160	2,377*	11,640*
31	860*	.....	855*	.....	2,696*	.....

*Discharges from Calgary Power Co. records taken at Horseshoe Falls.

Daily Discharge of Bow River at Horseshoe Falls from Calgary Power Co. records, 1911.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.
1	11,670	5,120	.....	2,150	1,260	920
2	11,500	5,195	4,500	2,130	1,270	935
3	11,300	5,370	4,600	2,160	1,210	890
4	10,000	5,570	5,100	2,200	1,230	945
5	9,329	5,685	4,900	2,130	1,200	910
6	9,213	5,550	.....	2,180	1,210	960
7	9,108	5,820	4,530	2,160	1,180	900
8	9,112	.....	4,275	.....	1,075	938
9	8,672	5,800	4,100	.....	700	960
10	8,341	5,925	4,690	1,668	630	945
11	7,950	5,460	3,700	1,790	650	920
12	7,702	5,370	3,700	1,860	620	890
13	6,080	4,980	3,650	1,860	625	910
14	5,840	4,890	3,650	1,860	625	870
15	5,850	4,710	3,540	1,846	750	880
16	5,950	4,920	3,450	1,880	950	860
17	6,652	4,840	3,350	1,908	1,060	835
18	6,590	4,780	3,275	1,750	1,120	790
19	6,530	4,670	3,150	1,770	1,110	835
20	6,140	4,650	2,950	1,725	1,075	810
21	6,050	4,530	2,875	1,715	1,050	800
22	5,950	4,490	2,875	1,645	1,020	685
23	5,930	4,475	2,750	1,610	975	790
24	5,790	4,395	2,670	1,860	1,025	725
25	5,765	4,395	2,590	1,846	975	735
26	5,940	4,310	2,508	1,707	1,020	740
27	6,400	4,274	2,440	1,566	940	725
28	5,905	4,365	2,350	1,494	675	675
29	5,525	4,390	2,350	1,620	735	663
30	5,480	4,420	2,300	1,605	850	675
31	5,215	4,455	.....	1,570	.....	700

SESSIONAL PAPER No. 25e

Daily Discharge Bow River at Horseshoe Falls from records of C. P. Co., 1912.

Day.	January.	February.	March.	April.	May.	June.
	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.
1	685	770	661	698	819	3,054
2	710	765	662	702	792	2,930
3	700	780	672	763	837	2,868
4	687	785	677	780	855	2,754
5	730	780	684	765	842	2,657
6	780	760	692	743	832	2,501
7	780	765	695	720	868	2,401
8	780	775	699	762	994	2,946
9	755	790	644	757	1,390	3,807
10	750	800	708	802	1,194	4,858
11	750	755	708	837	1,381	4,971
12	760	763	710	805	1,512	5,304
13	810	775	704	825	1,788	5,528
14	820	780	707	777	2,317	8,007
15	790	770	718	795	3,106	8,871
16	910	790	709	814	4,542	10,671
17	835	800	705	687	4,467	11,106
18	780	780	706	722	4,370	10,616
19	790	780	709	666	4,356	10,639
20	830	735	707	727	3,420	10,464
21	850	790	707	724	2,905	10,378
22	820	790	704	737	2,825	10,128
23	842	755	705	750	2,752	9,494
24	810	780	702	739	2,679	9,490
25	790	770	700	704	3,334	9,759
26	830	755	702	767	4,166	9,518
27	810	725	703	777	4,646	9,230
28	820	695	704	754	5,208	9,204
29	785	660	771	777	5,040	9,135
30			731	784	4,932	8,439
31			713		3,795	

Daily Discharge Bow River at Horseshoe Falls from records of C. P. Co., 1912.

Day.	November.	December.
	Sec.-ft.	Sec.-ft.
1		1,000
2		1,160
3		1,500
4		1,400
5		1,125
6	1,645	1,085
7	1,630	1,100
8	1,610	1,250
9	1,660	1,100
10	1,650	1,000
11	1,650	700
12	1,680	730
13	1,650	980
14	1,620	1,130
15	1,600	1,050
16	860	1,020
17	1,245	1,050
18	2,000	1,120
19	2,000	1,020
20	1,890	1,090
21	1,860	1,020
22	1,660	1,090
23	1,640	1,000
24	1,620	1,020
25	1,490	1,100
26	800	1,250
27	800	960
28	1,300	1,140
29	1,300	1,020
30	1,100	1,010
31		1,000

SESSIONAL PAPER No. 25e

Daily Discharge Bow River at Horseshoe Falls from records of C.P.R. Co., 1913.

Day.	January.	February.	March.
	Sec.-ft.	Sec.-ft.	Sec.-ft.
1	920	900	800
2	980	800	870
3	940	620	800
4	920	660	800
5	700	670	820
6	680	610	880
7	700	630	900
8	730	740	920
9	720	730	820
10	690	740	860
11	720	760	
12	730	760	
13	810	820	
14	850	860	
15	790	880	
16	750	800	
17	780	800	
18	710	800	
19	860	700	
20	800	820	
21	815	810	
22	810	715	
23	920	680	
24	910	725	
25	920	680	
26	800	630	
27	820	610	
28	940	530	
29	920		
30	940		
31	900		

APPENDIX VIII.

PRECIPITATION DATA.

PRECIPITATION TABLES.

Table No. 1.—Year 1911-12.

Month.	Banff	Jumping Pond.	Calgary.
	Precipitation.	Precipitation.	Precipitation.
	Inches.	Inches.	Inches.
October	0·56	.....	0·51
November	1·64	.....	0·61
December	1·04	.....	0·08
January	0·94	.....	0·60
February	0·20	.....	0·08
March	0·32	.....	0·34
April	1·35	.....	2·05
May	1·06	.....	1·42
June	3·02	.....	4·31
July	5·03	.....	5·60
August	3·94	.....	2·75
September	1·03	.....	2·80
Total	20·03	.....	20·55

Mean for years 1903-11, at Banff, 17·89 inches. Mean for 20 years at Banff, 19·13 inches.
Mean for 27 years at Calgary, 16·11 inches.

Table No. 2.—Year 1910-11.

Month.	Banff.	Jumping Pond.	Calgary.
	Precipitation.	Precipitation.	Precipitation.
	Inches.	Inches.	Inches.
October	1·36	0·49	0·48
November	0·99	0·23	0·34
December	0·90	0·16	0·17
January	3·12	0·75	0·44
February	0·65	0·21	0·56
March	0·54	0·65	1·04
April	1·15	0·10	1·06
May	1·36	2·82	5·03
June	2·84	3·05	2·63
July	1·38	2·64	2·17
August	3·76	.....	4·36
September	1·14	.....	0·89
	19·19	11·10	19·17

Table No. 3.—Year 1909-10

Month.	Banff.	Jumping Pond.	Calgary.
	Precipitation.	Precipitation.	Precipitation.
	Inches.	Inches.	Inches.
October	0·70	0·63	0·64
November	4·67	0·81	0·21
December	1·02	0·43	0·44
January	0·46	0·48	0·21
February	1·94	0·80	0·88
March	1·59	0·87	0·88
April	1·19	0·64	0·80
May	0·66	0·16	1·08
June	2·77	3·24	1·54
July	0·46	0·28	0·41
August	1·25	3·78	1·02
September	0·77	1·42	1·50
Total	17·48	13·54	9·64

Table No. 4.—Year 1908-09.

Month.	Banff.	Jumping Pond.	Calgary.
	Precipitation.	Precipitation.	Precipitation.
	Inches.	Inches.	Inches.
October	1·87	0·85	0·55
November	1·18	0·06	0·03
December	1·71	0·34	0·20
January	3·94	0·38	0·58
February	1·38	0·29	0·36
March	0·78	0·79	0·68
April	0·92	0·76	1·14
May	1·49	4·36	4·87
June	1·81	2·53	2·07
July	2·68	3·54	4·09
August	0·99	1·28	0·59
September	1·18	0·29	0·36
Total	19·93	15·47	15·52

Table No. 5.—Year 1907-08.

Month.	Banff.	Jumping Pond.	Calgary.
	Precipitation.	Precipitation.	Precipitation.
	Inches.	Inches.	Inches.
October	0·96	0·21	0·15
November	1·22	0·30	0·08
December	1·11	0·34	0·10
January	0·10	0·15	0·08
February	1·03	0·13	0·29
March	1·58	1·70	0·55
April	1·66	0·97	0·87
May	4·14	4·06	4·59
June	2·61	6·44	7·26
July	1·06	1·18	1·75
August	1·74	2·97	1·52
September	1·41	0·69	0·58
Total	18·62	19·14	17·80

Table No. 6.—Year 1906-07.

Month.	Banff.	Jumping Pond.	Calgary.
	Precipitation.	Precipitation.	Precipitation.
	Inches.	Inches.	Inches.
October	1·95	.....	0·82
November	0·87	.....	1·20
December	1·50	.....	0·00
January	1·64	.....	0·40
February	0·56	.....	0·20
March	1·55	.....	0·76
April	1·72	.....	1·79
May	3·39	.....	1·04
June	2·83	.....	3·76
July	1·90	.....	0·85
August	4·26	.....	3·34
September	2·60	.....	1·20
Total	23·77	.....	15·36

Table No. 7.—Year 1905-06.

Month.	Banff.	Jumping Pond.	Calgary.
	Precipitation.	Precipitation.	Precipitation.
	Inches.	Inches.	Inches.
October	1·66	.....	0·11
November	0·54	.....	1·20
December	0·45	.....	0·00
January	0·77	.....	0·04
February	0·40	.....	0·14
March	0·19	.....	0·70
April	0·32	.....	0·37
May	2·98	.....	6·96
June	1·91	.....	2·35
July	0·89	.....	1·15
August	2·26	.....	3·00
September	0·54	.....	0·04
Total	12·91	.....	16·06

Table No. 8.—Year 1904-05.

Month.	Banff.	Jumping Pond.	Calgary.
	Precipitation.	Precipitation.	Precipitation.
	Inches.	Inches.	Inches.
October	0·57	.....	1·35
November	0·90	.....	0·20
December	1·28	.....	0·31
January	0·55	.....	1·04
February	0·30	.....	0·30
March	0·90	.....	0·65
April	0·56	.....	0·80
May	3·06	.....	2·06
June	3·91	.....	6·01
July	1·43	.....	0·91
August	0·89	.....	0·69
September	1·72	.....	0·35
Total	16·07	.....	14·67

Table No. 9.—Year 1903-04.

Month.	Banff.	Jumping Pond	Calgary.
	Precipitation.	Precipitation.	Precipitation.
	Inches.	Inches.	Inches.
October	0·72	.....	0·00
November	2·00	.....	0·60
December	0·64	.....	0·25
January	1·31	.....	0·15
February	1·73	.....	0·15
March	1·35	.....	0·86
April	0·96	.....	0·14
May	0·78	.....	1·56
June	2·63	.....	1·99
July	0·87	.....	1·74
August	1·49	.....	2·75
September	0·74	.....	0·69
Total	15·22	.....	10·88

APPENDIX IX.

TEMPERATURE DATA.

TEMPERATURE TABLES.

1912

CALGARY.

Day of Month	January. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	February. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	March. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.
	°	°	°			°	°	°	°		°	°	°	
1	14	0	14	7	1	47	16	31	31·5	1	11	— 3	14	4
2	— 2	— 6	4	— 4	2	49	32	17	40·5	2	11	—10	21	0·5
3	17	—11	28	3	3	20	15	5	17·5	3	22	— 6	28	8
4	10	— 6	16	2	4	33	12	21	22·5	4	16	— 5	21	5·5
5	2	— 6	8	— 2	5	30	10	20	20	5	31	— 6	37	12·5
6	— 8	—23	15	—15·5	6	28	22	6	25	6	22	4	18	13
7	22	—10	32	6	7	17	15	2	16	7	25	— 2	27	12
8	12	5	7	8·5	8	25	10	15	17·5	8	36	— 3	39	17
9	—15	—20	5	—17·5	9	43	15	28	29	9	44	12	32	28
10	—16	—25	9	—20·5	10	46	24	22	35	10	40	12	28	26
11	—10	—30	20	—20	11	45	22	23	33·5	11	32	6	26	19
12	17	—10	27	3·5	12	45	20	25	32·5	12	20	11	9	15·5
13	— 3	—10	7	— 6·5	13	44	17	27	30·5	13	26	— 3	29	11·5
14	17	— 8	25	4·5	14	46	31	15	38·5	14	42	3	39	22·5
15	48	13	35	30·5	15	44	34	10	39	15	30	7	23	18·5
16	32	15	17	23·5	16	43	28	15	35·5	16	25	9	16	17
17	20	10	10	15	17	45	26	19	35·5	17	42	11	31	26·5
18	22	— 5	27	8·5	18	41	16	25	28·5	18	18	9	9	13·5
19	23	10	13	16·5	19	34	20	14	27	19	7	—16	23	—4·5
20	41	12	29	26·5	20	39	8	31	23·5	20	30	— 6	36	12
21	46	31	15	38·5	21	39	24	15	31·5	21	46	11	35	28·5
22	44	28	16	36	22	44	22	22	33	22	45	28	17	36·5
23	38	18	20	28	23	38	21	17	29·5	23	45	21	24	33
24	38	21	17	29·5	24	34	17	17	25·5	24	55	29	26	42
25	42	27	15	34·5	25	40	6	34	23	25	50	32	18	41
26	21	11	10	16	26	32	15	17	23·5	26	52	24	28	38
27	37	12	25	24·5	27	17	10	7	13·5	27	60	26	34	43
28	30	9	21	19·5	28	14	— 3	17	5·5	28	60	27	33	43·5
29	48	14	34	31	29	11	— 7	18	2	29	28	24	4	26
30	46	29	17	37·5						30	46	13	33	29·5
31	39	15	24	27						31	58	28	30	43
	672	110	548			1,033	498	535			1,075	287	788	
	21·68	3·55	18·13			35·62	17·17	18·45			34·68	9·26	25·42	

1912 CALGARY—*Continued.*

Day of Month.	April. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	May. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	June. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.
	°	°	°	°	°	°	°	°	°	°	°	°
1	58	28	30	43	37	33	4	35	70	38	32	54
2	66	33	33	49·5	42	33	9	37·5	58	33	25	45·5
3	64	26	38	42	50	31	19	40·5	59	30	29	44·5
4	42	27	15	34·5	54	28	26	41	54	36	18	45
5	41	26	15	33·5	60	32	28	46	60	33	27	46·5
6	53	14	39	33·5	64	40	24	52	66	29	37	47·5
7	64	30	34	47	74	41	33	57·5	77	35	42	56
8	63	27	36	45	74	44	30	59	87	40	47	63·5
9	65	29	36	47	54	36	18	45	70	50	20	60
10	60	34	26	47	60	35	25	47·5	75	40	35	57·5
11	36	33	3	34·5	65	32	33	48·5	85	42	43	63·5
12	38	32	6	35	67	30	37	49·5	86	46	40	66
13	40	30	10	35	78	36	42	57	70	54	16	62
14	54	28	26	41	81	44	37	63	64	42	22	63
15	58	26	32	42	82	44	38	63	64	46	18	55
16	50	34	16	42	68	49	19	58·5	69	50	19	59·5
17	54	28	26	41	67	42	25	54·5	73	48	25	60·5
18	55	26	29	40·5	64	40	24	52	80	44	36	62
19	54	27	27	40·5	46	40	6	43	82	51	31	66·5
20	56	24	32	40	52	42	10	47	84	50	34	67
21	58	32	26	45	54	33	21	43·5	85	49	36	67
22	54	27	27	40·5	50	40	10	45	86	60	26	73
23	55	34	21	44·5	63	41	22	52	84	59	25	71·5
24	60	26	34	43	72	40	32	56	88	57	31	72·5
25	47	30	17	38·5	72	39	33	55·5	89	59	30	74
26	53	28	25	40·5	66	51	15	58·5	90	52	38	71
27	47	30	17	38·5	60	49	11	54·5	81	59	22	70
28	61	34	27	47·5	66	33	33	49·5	71	49	22	60
29	60	29	31	44·5	66	35	31	50·5	55	48	7	51·5
30	40	37	3	38·5	58	35	23	46·5	51	47	4	49
					68	30	38	49				
	1,606	869	737		1,934	1,178	756		2,213	1,376	337	
	53·53	28·96	24·56		62·39	38·00	24·39		75·76	45·86	27·30	

1912 CALGARY—*Continued.*

Day of Month.	July. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	August. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	September. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.
	°	°	°	°		°	°	°	°		°	°	°	°
1	54	43	11	48·5	1	74	49	25	61·5	1	60	35	25	37·5
2	50	47	3	48·5	2	69	55	14	62	2	56	36	20	46
3	72	36	36	54	3	67	48	19	57·5	3	53	35	18	44
4	72	43	29	57·5	4	68	56	12	62	4	53	32	21	42·5
5	63	50	13	56·5	5	68	44	24	56	5	45	42	3	43·5
6	63	48	15	55·5	6	67	42	25	56·5	6	63	33	30	48
7	53	48	5	50·5	7	73	50	23	61·5	7	64	45	19	54·5
8	58	46	12	52	8	75	47	28	61	8	52	45	7	48·5
9	68	46	22	57	9	80	48	32	64	9	65	40	25	52·5
10	65	42	23	53·5	10	75	54	21	64·5	10	66	40	26	53
11	66	50	16	58	11	56	46	10	51	11	72	40	32	56
12	74	43	31	58·5	12	67	45	22	56	12	66	46	20	56
13	51	45	6	48	13	68	44	24	56	13	54	42	12	48
14	71	33	38	52	14	72	42	30	57	14	51	34	17	42·5
15	76	45	31	60·5	15	71	43	28	57	15	59	25	34	42
16	61	45	16	53	16	60	53	7	56·5	16	68	30	38	49
17	66	46	20	56	17	60	45	15	52·5	17	71	37	34	54
18	72	40	32	56	18	68	42	26	55	18	63	36	27	49·5
19	69	47	22	58	19	70	46	24	58	19	54	36	18	45
20	56	48	8	52	20	78	46	32	62	20	58	33	25	45·5
21	75	48	27	61·5	21	80	54	26	67	21	66	32	34	49
22	75	49	26	62	22	82	56	26	69	22	39	35	4	37
23	65	51	14	58	23	78	53	25	65·5	23	40	32	8	36
24	54	50	4	52	24	65	50	15	57·5	24	51	25	26	38
25	71	48	23	59·5	25	54	44	10	49	25	47	37	10	42
26	73	46	27	59·5	26	66	48	18	57	26	51	32	19	41·5
27	73	44	29	58·5	27	64	48	16	56	27	49	37	12	43
28	78	42	36	60	28	57	47	10	52	28	53	27	26	40
29	77	48	29	62·5	29	55	40	15	47·5	29	70	25	45	47·
30	79	47	32	63	30	61	30	31	45·5	30	69	37	32	53
31	78	50	28	64	31	60	35	25	47·5					
	2,078	1,414	664			2,108	1,450	658			1,728	1,061	667	
	67·0	45·6	21·4			68·0	46·7	21·2			57·6	35·36	22·23	

1912 CALGARY—*Continued.*

Day of Month.	October. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	November. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	December. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.
	°	°	°	°		°	°	°	°		°	°	°	°
1	62	42	20	52	1	51	25	26	38	1	20	0	20	10
2	66	34	32	50	2	47	30	17	38·5	2	40	10	30	25
3	70	44	26	57	3	44	30	14	37	3	42	18	24	30
4	47	38	9	42·5	4	45	21	24	33	4	22	15	7	18·5
5	45	30	14	37	5	52	22	30	32	5	40	15	25	27·5
6	60	20	40	40	6	48	19	29	33·5	6	51	21	30	36
7	59	30	29	44·5	7	46	21	25	33·5	7	42	32	10	37
8	40	33	7	36·5	8	45	24	21	34·5	8	50	32	18	41
9	36	29	7	32·5	9	44	24	20	34	9	39	31	8	35
10	53	26	27	39·5	10	29	24	5	26·5	10	27	13	14	20
11	54	26	28	40	11	36	14	22	25	11	39	5	34	22
12	58	27	31	42·5	12	37	18	19	27·5	12	44	20	24	32
13	68	35	33	51·5	13	51	19	32	35	13	48	25	23	36·5
14	66	35	31	50·5	14	36	26	10	31	14	40	25	15	32·5
15	67	40	27	53·5	15	31	11	20	21	15	24	16	8	20
16	56	34	22	45	16	44	12	32	28	16	29	14	15	21·5
17	40	31	9	35·5	17	58	30	28	44	17	34	17	17	25·5
18	43	26	17	34·5	18	48	31	17	39·5	18	40	14	26	27
19	40	31	9	35·5	19	47	24	23	35·5	19	35	22	13	28·5
20	40	30	10	35	20	45	26	19	35·5	20	31	16	15	23·5
21	43	15	28	29	21	43	32	11	37·5	21	40	13	27	26·5
22	53	15	38	34	22	44	28	16	36	22	44	34	10	39
23	48	32	16	40	23	55	24	31	39·5	23	42	25	17	23·5
24	48	20	28	34	24	42	27	15	34·5	24	30	20	10	25
25	54	24	30	39	25	33	12	21	22·5	25	42	9	33	25·5
26	55	27	28	41	26	33	14	19	23·5	26	46	20	26	33
27	46	25	21	35·5	27	51	16	35	33·5	27	48	26	22	37
28	40	31	9	35·5	28	38	16	22	27	28	34	21	13	27·5
29	39	21	18	30	29	35	18	17	26·5	29	39	15	24	27
30	39	20	19	29·5	30	23	11	12	17	30	35	21	14	28
31	52	22	30	37						31	43	18	25	30·5
	1,586	893	693			1,281	649	622			1,180	593	597	
	51·16	28·8	22·35			42·7	21·63	20·73			38·06	19·13	19·19	

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1912 BANFF.

Day of Month.	JANUARY. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	FEBRUARY. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	MARCH. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.
	°	°	°	°		°	°	°	°		°	°	°	°
1	7·7	−11	18·7	− 2	1	34·2	11·1	23·1	22·6	1	14·3	2·5	11·8	8·5
2	4·5	−25·2	29·7	−10	2	38·2	10·2	28·0	24	2	21·2	−20·2	42·4	1
3	10·4	− 6	16·4	2	3	27	− 1·1	28·1	13	3	25·7	−13·4	39·1	6
4	4·8	− 8·2	13	− 0·7	4	25·2	− 3·3	28·5	12	4	25·5	−13·7	39·2	6
5	5	3·2	8·2	1	5	35·2	3·5	31·7	19	5	33·2	−12	45·2	11
6	− 1	−31·6	30·6	−16	6	33	26	7	29·5	6	30·2	− 4·7	34·9	13
7	15·3	−18·4	33·7	− 1	7	28·2	17·2	11·0	23	7	26·2	−17·6	43·8	5
8	15·2	− 8·8	24·0	− 4	8	35·5	9·8	25·7	22·5	8	39·8	−14·4	54·2	13
9	− 2	−23·6	21·6	−13	9	36·1	23·2	12·9	30	9	39·2	− 3·8	43·0	18
10	−18·8	−28·8	10	−23	10	38·8	29	9·8	34	10	37·2	− 3·8	41·0	16·7
11	12·2	−37·6	49·8	−12	11	37·1	24·8	12·3	31	11	37·2	− 2·1	39·3	17·5
12	23·2	7·2	16·0	−15	12	34·1	18·1	16·0	26	12	30·2	3·9	36·3	21
13	35·8	5·8	30·0	20·8	13	36·5	21·9	14·6	29	13	33·2	− 7·9	41·2	12·5
14	44·6	1·4	43·2	23	14	38·2	29	9·2	33·6	14	33·3	− 0·8	34·1	16
15	45	34·6	10·4	40	15	35·8	31·2	4·6	33	15	36·9	13·8	23·1	25
16	37	19·7	17·3	27	16	38	28·2	9·8	33	16	35·3	2·3	33·0	19
17	20·2	− 4·7	24·9	8	17	36·1	25·1	11·0	30·6	17	33·3	24	9·3	28·6
18	14·1	−16	30·1	− 1	18	35·3	19·8	15·5	27	18	28·4	13·7	14·7	21
19	12·2	− 2·8	15·0	5	19	31·2	12·6	18·6	22	19	23·2	−14·4	37·6	4·4
20	22·6	1·1	21·5	12	10	28·6	− 2·3	30·9	14	20	35	− 8·8	43·8	13
21	35	18·5	16·5	26	21	32·3	18·4	13·9	25	21	40·2	9·9	30·3	25
22	33	16·2	16·8	24	22	34	22	12	28	22	44	18·3	25·7	31
23	28	11·3	16·7	19	23	33	1·3	31·7	17	23	46·1	12	34·1	29
24	31	13	18	22	24	30·8	0·8	30	15·8	24	49·7	18·4	31·3	34
25	39·4	28·1	11·3	33·5	25	30·6	1·7	28·9	17	25	46·9	29·9	17·0	38
26	37·2	11·8	25·4	24	26	29	15·2	13·8	22	26	46·8	23	23·8	35
27	52·1	15·2	16·9	23	27	24·3	4·9	19·4	15	27	50·9	27·1	23·8	39
28	31·8	12·5	19·3	22	28	17	−13·4	30·4	2	28	47·3	36·4	10·9	42
29	42	26·3	15·7	34	29	17·9	−20·4	38·3	− 1	29	39·8	25·8	14·0	33
30	38·4	30·7	7·7	34						30	44·3	11·9	32·4	28
31	32	9·2	22·8	20						31	50·6	29·7	20·9	40
	709·7	262·6	651·2			931·2	405·0	566·7			1125·2	302·6	960·8	
	− 21·8	−225·9		.....			−40·5		.....	.....		−138·8		.....
	687·9	36·7					364·5					163·8		
	22·79	1·18	21·0	.....	.....	32·11	12·57	19·54	.....	.....	36·29	5·3	30·99	.....

1912 BANFF—*Continued.*

Day of Month.	April. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	May. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	June. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.
	°	°	°	°		°	°	°	°		°	°	°	°
1	48·7	35·4	13·3	42	1	41·0	31·8	9·2	36	1	58·7	32	26·7	45
2	55·6	40·0	15·6	48	2	46	30·0	16	38	2	54·1	39·7	14·4	47
3	52·2	36·2	16·0	44	3	51·4	29·2	22·2	40	3	54·7	32·8	21·9	43
4	42·3	29·4	12·9	36	4	52·4	26·2	26·2	39	4	55·9	33·3	22·6	44·6
5	38·0	25·2	12·8	32	5	55·9	27	28·9	41	5	58·4	33·2	25·2	46
6	45·1	17·0	28·1	31	6	62·1	31·3	30·8	47	6	68·2	27·4	40·8	47·8
7	46·3	30·9	15·4	38·6	7	67·2	32·3	34·9	49·7	7	78	30·2	47·8	54
8	55·5	28·7	26·8	42	8	67·5	45·8	21·7	56	8	78·2	36·8	41·4	57
9	56·1	28·3	27·8	42	9	59·8	33·8	26	47	9	73·9	43·9	30·0	59
10	59·1	27·9	31·2	43	10	56·2	26·6	29·6	41	10	73·4	31·8	41·6	52
11	51·3	32·2	19·1	42	11	61·2	24·4	36·8	42·5	11	77·5	39·8	37·7	58
12	40·8	30·8	10·0	36	12	68·2	26·2	42·0	47	12	78·3	45·7	32·6	62
13	44·4	30·9	13·5	37	13	74·5	28·9	45·6	51·7	13	67·3	48·3	19·0	58
14	52·9	27·2	25·7	40	14	76·9	31·9	45	54·4	14	63·5	39·4	24·1	51
15	48·7	27·2	21·5	38	15	74·1	31·4	42·7	53	15	48·7	37·3	11·4	43
16	45·2	29·5	15·7	37	16	66·9	46·4	20·5	56	16	66·3	44·3	22·0	55
17	46·1	25·2	20·9	35·5	17	61·2	36·8	24·4	49	17	74	39·8	34·2	57
18	49·2	29·0	20·2	39	18	56·3	35·6	20·7	46	18	80·3	40·2	40·1	60
19	49·2	27·0	22·2	38	19	49	36·2	12·8	42·6	19	81·4	42·2	39·2	62
20	48·0	23·5	24·5	36	20	45·6	38·7	6·9	42	20	83·4	44·7	38·7	64
21	53·3	24·8	28·5	39	21	58	34·2	23·8	45	21	84·5	44·2	40·3	64
22	51·0	22·0	29·0	36·5	22	54·3	40	14·3	47	22	84·1	47·6	36·5	66
23	49·2	32·0	17·2	40·6	23	58·7	36·9	21·8	47	23	84·7	50·8	33·9	67
24	50·6	32·0	18·6	41·3	24	63·2	40·5	22·7	52	24	85·7	52·3	33·4	69
25	52·6	28·0	24·6	40	25	67·7	31·9	35·8	50	25	84·2	49	35·2	66
26	49·2	28·5	20·7	39	26	65·4	42·2	23·2	54	26	83·1	46·4	36·7	64·7
27	51·2	28·5	22·7	40	27	60·1	46·7	13·4	54	27	73·4	47·5	25·9	60
28	49·6	29·8	19·8	39	28	55·9	38·3	17·6	46·8	28	62·4	44·2	18·2	53
29	51·9	29·0	22·9	40·4	29	57·3	33·4	23·9	45	29	60·3	34·8	25·2	47
30	47·2	33·5	13·7	40	30	55·4	30·1	25·3	42·6	30	51	44·2	6·8	47·6
					31	56·8	29·6	27·2	43					
	1480·5	869·6	610·9			1846·2	1054·3	791·9			2127·6	1223·8	903·8	
	49·35	28·99	20·36			59·55	34·00	25·54			70·92	40·79	30·13	

1912 BANFF—*Continued.*

Day of Month.	July. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	August. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	September. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.
	°	°	°	°		°	°	°	°		°	°	°	°
1	58·5	43·2	15·3	50·8	1	75	46·9	28·1	61	1	48·9	35·2	13·7	42
2	53·3	41·5	11·8	47·4	2	68·2	45	23·2	56·6	2	45	32	13	38·5
3	61·4	37·9	23·5	49·6	3	69·9	46·5	23·4	68·2	3	46	34·8	11·2	40·4
4	69·2	42	27·2	55·6	4	67·7	52	15·7	59·8	4	53·3	28	25·3	40·6
5	65	45·6	19·4	55·3	5	58·8	40·5	18·3	49·6	5	50·5	37·5	13	44
6	57	42·3	14·7	49·6	6	58·5	34	24·5	46	6	55·9	33·8	22·1	44·8
7	54·1	45·2	8·9	49·6	7	67·5	44	23·5	55·7	7	59·9	41	18·9	50·4
8	58·3	40·3	18·0	49·3	8	76·1	39·9	36·2	58	8	54·8	41·9	12·9	48·3
9	63·7	43·8	19·9	53·7	9	74·4	45·6	28·8	60	9	58·8	32·3	26·5	45·5
10	63·3	42·2	21·1	52·8	10	69·2	49·4	19·8	59·3	10	68·5	30	38·5	49
11	61·6	45·7	15·9	53·6	11	57·4	44·8	12·6	51	11	73·1	33·3	39·8	53·2
12	64·3	40·3	24·0	52·3	12	61·4	41·7	19·7	51·5	12	65·9	37·8	28·1	51·8
13	59	40·2	18·8	49·6	13	65·5	32	33·5	48·7	13	59·2	35·4	23·8	47
14	59·9	33·8	26·1	46·8	14	73·1	34·2	38·9	53·6	14	55·6	24·8	30·8	40·2
15	69·7	44·2	25·5	57	15	71·4	37·9	33·5	54·6	15	63·3	24·8	38·5	44
16	65·8	43·9	21·9	54·8	16	60·3	42·3	18·0	51·3	16	67·8	30·1	37·7	48·9
17	63·5	43·2	20·3	53·4	17	48	35·1	12·9	41·5	17	64·2	32·9	31·3	48·5
18	74·4	35·3	39·1	54·8	18	63·2	36·7	26·5	50	18	57·9	40·7	17·2	49·3
19	73·3	40·8	32·5	57	19	68·6	36·3	32·3	52·4	19	49·9	30·8	19·1	40·6
20	61·3	47·9	13·4	54·6	20	73·4	39·5	33·9	56·4	20	58·3	26·9	31·4	42·6
21	71·6	41·3	30·3	56·4	21	76·3	40·5	35·8	58·3	21	65·4	28·3	37·1	46·8
22	65	44	21	55·5	22	79·1	46·2	32·9	62·6	22	60	32·2	27·8	46
23	61·1	44·6	16·5	52·8	23	73·8	52·2	21·6	63	23	36·8	28·8	8·0	32·8
24	52·1	45·4	6·7	48·7	24	67·1	47·9	19·2	57·5	24	43·4	25·8	17·6	34·6
25	66·3	38·2	28·1	52·3	25	53·3	40·8	12·5	47	25	40·2	32·9	7·3	37·5
26	66·1	36·9	29·2	51·5	26	59·1	42	17·1	50·6	26	46·9	30	16·9	38·4
27	64·4	37	27·4	50·7	27	62	43·3	18·7	52·6	27	47	30·9	16·1	39
28	72·4	38·6	33·8	55	28	52	39·3	12·7	45·6	28	56·3	23·4	32·9	39·8
29	77·5	38·2	39·3	57·7	29	48·9	33	15·9	41	29	64·8	27·8	37·0	46·3
30	82·9	39·3	43·6	61	30	49·9	35·5	14·4	42·7	30	58·8	33·8	25·0	46·3
31	76	44·3	31·7	60	31	50·1	38·2	11·9	44					
	2012	1287·1	724·9			1999·2	1283·2	716·0			1676·4	957·9	718·5	
	64·9	41·5	23·38			64·5	41·39	23·09			55·8	31·9	23·9	

1912 BANFF—*Continued.*

Day of Month.	October. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	November. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	December. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.
	°	°	°	°		°	°	°	°		°	°	°	°
1	55	39	16	47	1	33	21	12	27	1	28	2	26	15
2	55	42	13	48·5	2	38	17	21	27·5	2	30	20	10	25
3	53	44	9	48·5	3	38	27	11	32·5	3	28	24	4	26
4	45	31	14	38	4	36	19	17	27·5	4	23	13	10	18
5	39	29	10	34	5	39	24	15	31·5	5	28	8	20	18
6	49	20	29	34·5	6	37	24	13	30·5	6	38	20	18	29
7	51	30	21	41·5	7	36	24	12	30	7	32	23	9	27·5
8	44	32	12	38	8	31	25	6	28	8	28	18	10	23
9	42	26	16	34	9	34	26	8	30	9	30	17	13	23·5
10	46	34	12	40	10	34	19	15	26·5	10	12	− 4	16	4
11	48	28	20	38	11	37	26	11	31·5	11	22	0	22	11
12	52	26	26	39	12	44	28	16	36	12	27	17	10	22
13	55	33	22	34	13	48	30	18	39	13	34	18	16	26
14	58	27	31	38·5	14	32	25	7	28·5	14	31	25	6	28
15	57	31	26	44	15	27	5	22	16	15	19	− 1	20	9
16	53	40	13	46·5	16	28	15	13	21·5	16	26	5	21	15·5
17	41	34	7	37·5	17	43	25	18	36	17	28	11	17	19·5
18	39	30	9	34·5	18	45	36	9	40·5	18	32	20	12	26
19	35	26	9	30·5	19	38	33	5	35·5	19	25	20	5	22·5
20	35	20	15	27·5	20	34	27	7	30·5	20	21	12	9	16·5
21	33	16	17	24·5	21	38	39	9	33·5	21	25	0	25	12·5
22	37	27	10	32	22	40	29	11	34·5	22	28	19	9	23·5
23	35	25	10	30	23	45	33	12	39	23	33	20	13	26·5
24	37	26	11	31·5	24	32	23	9	27·5	24	26	15	11	20·5
25	42	25	17	33·5	25	25	5	20	15	25	25	0	25	12·5
26	40	30	10	35	26	22	− 4	26	9	26	37	22	15	29·5
27	39	19	19	28·5	27	33	14	19	23·5	27	30	25	5	27·5
28	35	23	12	29	28	28	13	15	20·5	28	23	17	6	20
29	31	8	23	19·5	29	24	14	10	19	29	24	20	4	22
30	35	5	30	20	30	27	13	14	20	30	28	17	11	22·5
31	38	7	31	22·5						31	30	24	6	27
	1353	833	520			1046	645	401			851	447	404	
	43·64	26·87	16·77			34·86	21·5	13·36			27·45	14·42	13·03	

1911

CALGARY.

Day of Month.	January. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	February. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	March. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.
	°	°	°	°		°	°	°	°		°	°	°	°
1	− 7	−29	22	−18	1	−15	−19	4	−17	1	46	14	32	30
2	42	−13	55	15	2	− 2	−22	20	−12	2	43	30	13	37
3	38	26	12	32	3	24	− 6	30	9	3	25	24	1	24
4	46	8	38	27	4	11	6	5	9	4	32	10	22	21
5	44	20	24	32	5	12	3	9	8	5	38	15	23	27
6	36	24	12	30	6	31	− 9	40	11	6	46	22	24	34
7	34	18	16	26	7	32	2	30	17	7	50	20	30	35
8	19	−10	29	4	8	27	2	25	14	8	27	19	8	23
9	−22	−25	3	−23	9	43	6	37	25	9	38	13	25	25
10	−29	−30	1	−29·5	10	40	24	16	32	10	44	24	20	34
11	−30	−33	3	−31	11	34	14	20	24	11	38	10	28	24
12	−34	−44	10	−39	12	35	21	14	28	12	50	27	23	39
13	−24	−44	20	−34	13	37	14	23	26	13	55	31	24	43
14	5	−28	33	−12	14	31	20	11	26	14	25	15	10	20
15	11	−16	27	− 3	15	20	14	6	17	15	48	19	29	34
16	12	− 7	19	3	16	25	− 6	31	9	16	47	27	20	37
17	38	− 2	40	18	17	22	4	18	13	17	56	22	34	39
18	0	−11	11	−5·5	18	20	− 6	26	7	18	52	30	22	41
19	4	− 9	13	− 2	19	22	− 6	28	8	19	64	43	21	53
20	1	−17	18	− 8	20	17	5	12	11	20	63	30	33	46
21	− 3	−14	11	− 8	21	16	− 9	25	3	21	36	28	8	32
22	28	−12	40	8	22	36	− 4	40	16	22	54	30	24	42
23	34	12	22	22	23	44	10	34	27	23	62	34	28	48
24	− 3	−10	7	− 6	24	36	27	9	31	24	48	33	15	41
25	−16	−20	4	−18	25	25	19	6	22	25	42	30	12	36
26	−20	−26	6	−23	26	15	7	8	11	26	43	14	29	29
27	7	−29	36	−11	27	25	− 2	27	11	27	47	30	17	38
28	− 1	− 5	4	− 3	28	42	4	38	23	28	53	32	21	42
29	34	−12	46	11						29	45	30	15	38
30	38	25	13	32						30	36	32	4	34
31	− 6	−11	5	− 9						31	32	25	7	29
	276	−324	600	.....		705	113	592	.....		1,385	763	622	.....
Mean	8·9	10·45	19·35	.....	Mean	25·18	4·04	21·14	.....	Mean	44·67	24·6	20·06	34·64

1911 CALGARY—*Continued.*

Day of Month.	April. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	May. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	June. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.
	°	°	°	°		°	°	°	°		°	°	°	°
1	28	24	4	26	1	57	26	31	41	1	71	49	22	60
2	26	17	9	22	2	65	26	39	46	2	76	45	31	60
3	10	6	4	8	3	66	37	29	52	3	62	42	20	52
4	13	−13	26	0	4	72	37	35	53	4	59	44	15	52
5	32	− 1	33	15	5	83	40	43	62	5	67	38	29	53
6	40	10	30	25	6	52	48	4	50	6	62	36	26	49
7	40	7	33	23	7	63	28	35	45	7	47	43	4	45
8	53	18	35	35	8	63	37	26	50	8	62	42	20	52
9	53	28	25	40	9	59	30	29	45	9	72	40	32	56
10	52	29	23	42	10	50	38	12	44	10	74	46	28	60
11	38	29	9	34	11	61	30	31	45	11	80	42	38	61
12	36	19	17	27	12	53	40	13	47	12	79	52	27	66
13	42	23	19	33	13	42	40	2	41	13	74	46	28	60
14	50	30	20	40	14	58	36	22	47	14	74	61	26	61
15	62	27	35	44	15	63	39	24	51	15	72	41	31	56
16	60	32	28	46	16	53	46	7	50	16	81	46	35	63
17	48	29	19	39	17	56	43	13	50	17	82	46	36	64
18	56	26	30	41	18	63	31	32	47	18	82	48	34	65
19	58	38	20	48	19	56	40	16	48	19	69	46	23	58
20	66	29	37	48	20	66	36	30	51	20	68	50	18	59
21	74	30	44	52	21	56	42	14	49	21	67	47	20	57
22	54	40	14	47	22	38	34	4	36	22	80	52	28	56
23	61	32	29	47	23	42	32	10	37	23	70	47	23	59
24	73	31	42	52	24	41	32	9	36	24	55	50	5	53
25	67	42	25	54	25	45	31	14	38	25	66	48	18	57
26	58	34	24	46	26	49	33	16	41	26	69	47	22	58
27	42	28	14	35	27	51	34	17	42	27	68	46	22	57
28	50	25	25	37	28	68	29	34	46	28	66	51	15	59
29	57	23	34	40	29	72	34	38	53	29	66	46	20	56
30	61	25	36	43	30	78	45	33	62	30	62	49	13	56
					31	78	45	33	62					
	1,460	717	743			1,814	1,119	695			2,082	1,373	709	
Mean	48·67	23·90	24·77	36·29	Mean	58·51	36·09	22·42	47·3	Mean	69·4	45·7	23·63	57·6

1911 CALGARY—*Continued.*

Day of Month.	July. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	August. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	September. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.
	°	°	°	°		°	°	°	°		°	°	°	°
1	65	47	18	56	1	64	48	16	56	1	66	42	24	56
2	70	44	26	57	2	65	50	15	57	2	72	44	28	62
3	67	46	21	56	3	66	49	17	57	3	56	54	2	55
4	55	38	17	46	4	56	44	12	50	4	56	43	13	49
5	72	33	39	53	5	62	39	23	51	5	48	40	8	44
6	82	46	36	64	6	58	48	10	53	6	56	40	16	48
7	69	44	25	56	7	48	46	2	47	7	60	28	32	44
8	64	40	24	52	8	52	40	12	46	8	64	32	32	48
9	64	45	19	55	9	64	36	28	50	9	66	38	28	52
10	65	42	23	54	10	70	36	34	53	10	74	37	37	55
11	63	44	19	54	11	72	46	26	59	11	74	38	36	56
12	69	39	30	54	12	78	42	36	60	12	74	44	30	59
13	76	41	35	59	13	76	46	30	61	13	70	47	23	59
14	81	47	34	64	14	68	40	28	54	14	68	52	16	60
15	78	53	25	65	15	54	50	4	52	15	68	40	28	54
16	82	48	34	65	16	70	38	32	54	16	56	30	26	43
17	60	54	6	57	17	76	44	32	60	17	53	42	11	47
18	60	47	13	53	18	77	45	32	61	18	58	36	22	47
19	60	43	17	51	19	77	40	37	58	19	55	36	19	46
20	70	36	34	53	20	63	47	16	55	20	60	31	29	46
21	54	49	5	52	21	60	41	19	51	21	34	30	4	32
22	62	49	13	56	22	58	44	14	51	22	34	28	6	31
23	71	40	31	55	23	69	34	34	51	23	37	26	11	31
24	78	47	31	63	24	74	41	33	58	24	42	21	21	31
25	88	50	38	69	25	54	48	6	51	25	54	26	48	40
25	65	50	15	58	26	50	44	6	47	26	60	32	38	46
27	70	45	25	58	27	64	33	31	48	27	65	30	35	47
28	78	49	29	64	28	75	42	33	58	28	61	38	23	50
29	62	48	14	55	29	72	44	28	58	29	60	32	28	46
30	64	45	19	55	30	75	44	31	60	30	54	31	23	43
31	68	40	28	54	31	68	45	23	57					
	2,132	1,389	743			2,034	1,334	700			1,755	1,088	667	
Mean	68·7	44·8	23·9	56·79		65·6	43·03	22·5	54·3		58·5	36·27	22·23	

1911 CALGARY—*Continued.*

Day of Month.	October. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	November. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	December. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp
	°	°	°	°		°	°	°	°		°	°	°	°
1	55	38	17	46	1	32	4	28	18	1	50	22	28	36
2	38	34	4	36	2	50	18	32	34	2	44	27	17	35
3	50	34	16	42	3	48	26	22	37	3	48	26	22	37
4	56	30	26	43	4	43	32	11	37	4	44	32	12	38
5	56	28	28	42	5	40	21	19	31	5	41	26	15	34
6	65	30	35	47	6	34	24	9	30	6	41	14	27	28
7	74	31	43	53	7	14	8	6	11	7	44	26	18	35
8	74	40	34	57	8	3	0	3	2	8	44	24	20	34
9	74	37	37	55	9	− 6	−10	4	− 8	9	39	30	9	35
10	68	43	25	55	10	− 8	−21	13	−15	10	35	20	15	28
11	58	42	16	50	11	1	−20	21	−10	11	40	12	28	26
12	61	33	28	47	12	6	−17	23	− 5	12	40	26	14	33
13	62	34	28	48	13	−10	−16	6	−13	13	41	17	24	29
14	59	42	17	50	14	− 6	−17	11	−12	14	42	20	22	31
15	60	34	26	47	15	37	−13	50	12	15	38	15	23	27
16	60	32	28	46	16	25	0	25	12	16	38	20	18	29
17	46	27	19	37	17	40	18	22	29	17	28	14	14	21
18	40	26	14	33	18	48	14	34	31	18	39	6	33	22
19	42	17	25	29	19	39	25	14	32	19	34	28	6	31
20	46	25	21	35	20	32	20	12	26	20	32	26	6	29
21	60	34	26	47	21	39	14	25	26	21	37	8	29	23
22	53	35	18	44	22	30	8	22	19	22	50	26	24	38
23	36	34	2	35	23	45	17	28	31	23	28	11	17	20
24	32	32	10	27	24	51	18	33	34	24	12	4	8	8
25	38	14	24	26	25	37	28	9	33	25	24	− 3	27	11
26	37	15	22	26	26	26	18	8	22	26	14	5	9	10
27	42	14	28	28	27	18	6	12	12	27	0	−10	10	− 5
28	52	17	35	34	28	44	2	42	23	28	−10	−20	10	−15
29	44	20	24	32	29	44	31	13	38	29	−21	−26	5	−24
30	37	20	17	29	30	45	34	11	40	30	−19	−30	11	−24
31	25	20	5	22						31	12	−26	38	− 7
	1,600	902	698	.....		841	273	568	.....		929	370	559	.....
	51·61	29·09	22·52	.....		28·03	9.10	18·93	.....		29·97	11·94	18·04	

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Day of Month.	January. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	February. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	March. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.
	°	°	°	°		°	°	°	°		°	°	°	°
1	−11·8	−32·7	20·9	−22·2	1	−7·8	−19·5	11·7	13·7	1	41·3	5·1	36·2	23·2
2	9·1	−23·4	82·5	−7·2	2	17·2	−29·8	47	−6·3	2	41·3	14·3	26·7	27·7
3	25·9	6·3	19·6	16·1	3	22·7	12·2	10·5	17·5	3	36·2	20·8	15·4	28·5
4	33·6	15	18·6	24·3	4	24	10·9	13·1	17·5	4	34·9	2·9	32·0	18·9
5	33·8	28·2	5·6	31·0	5	31·1	13·2	18·1	22·3	5	34·4	5	29·4	19·8
6	35·7	28·4	7·3	32·1	6	25·2	13·6	11·6	19·4	6	40·8	20·5	20·3	30·7
7	32	23·2	8·8	27·6	7	23·6	10·8	12·8	17·2	7	40·2	30·7	9·5	35·5
8	24	− 4·2	28·2	9·9	8	24·1	5·9	18·2	15·0	8	34·7	27·8	6·9	31·3
9	− 4	−26	22	−15·0	9	33·7	16·2	17·5	25·0	9	34·4	25·7	8·7	30·1
10	−24·6	−33·3	8·7	−29·0	10	32·8	17·8	15	25·3	10	32·6	27·7	4·9	30·2
11	−28·4	−32·8	4·4	−30·6	11	35·6	12·6	23	24·1	11	32	21·2	10·8	26·6
12	−30·7	−36·5	5·8	−33·6	12	30·3	18·4	11·9	24·4	12	39·8	23·3	16·5	31·6
13	2·8	−36·5	39·3	−16·9	13	27·7	6·9	20·8	17·3	13	42·6	33·8	8·8	38·2
14	5	−14·3	19·3	−4·7	14	28·3	4·8	23·5	16·6	14	40	18·9	21·1	29·5
15	14·2	− 6·3	20·5	4·0	15	24·4	7	17·4	15·7	15	45·6	17·8	27·8	31·7
16	20·2	3·2	17	11·7	16	21·7	−8·3	30·0	6·7	16	45·2	22·7	22·5	38·9
17	31	13·2	17·8	22·1	17	25	4·7	20·3	14·9	17	43·8	14·5	29·3	29·2
18	30·7	−1·6	32·3	14·6	18	24·3	−7·3	31·6	8·5	18	47·6	29·9	17·7	38·8
19	25·9	1·2	24·7	13·6	19	24·3	−15·3	39·6	4·5	19	50	38·5	11·5	44·3
20	23·3	8·2	15·8	15·7	20	24·4	14·1	10·3	19·3	20	49·4	36·9	12·5	43·2
21	18·3	−6·6	24	5·9	21	32	−14·6	46·6	8·7	21	46·3	28·8	17·5	37·6
22	20·1	10·7	9·4	15·4	22	31·3	−8·2	39·5	11·6	22	52·1	26·3	25·3	39·2
23	22·2	17·2	5·0	19·7	23	36·2	−4	40·2	16·1	23	50	29·4	20·6	39·7
24	26·2	3	23·2	14·6	24	33	20·4	12·6	26·7	24	42·3	29·5	12·8	35·9
25	3·7	−18	21·7	−7·2	25	23	−2·5	25·3	10·4	25	34·8	23·2	11·6	29·0
26	−10·2	−23·4	13·2	−16·8	26	19·3	−5·2	24·5	7·1	26	36·7	13·1	23·6	24·9
27	18	−32	50	−7·0	27	27	−8·3	35·3	9·4	27	38·2	24	14·2	31·1
28	25·8	13	12·8	19·4	28	36·1	−4·4	40·5	15·9	28	44·2	31·8	12·4	38·0
29	21·6	5·7	15·9	13·7						29	48	36·6	11·4	42·3
30	30·9	17	13·9	24·0						30	44·6	28·3	16·3	36·5
31	26·8	−8·2	35	9·3						31	31·1	21·7	9·4	26·4
	451·1	−230·0	593·4			730·7	62·3	668·4			1274·8	730·5	544·1	
	14·55	−7·42	19·14	6·42		26·09	2·22	23·87	14·15		41·12	23·57	17·55	32·40

1911 BANFF—*Continued.*

Day of Month.	April. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	May. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	June. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.
	°	°	°	°		°	°	°	°		°	°	°	°
1	28·3	21·8	6·5	25·1	1	57	28·4	28·6	42·7	1	71	33·8	37·2	52·4
2	23·3	12·8	10·5	18·1	2	54·6	25·9	28·7	40·3	2	71·3	35·2	36·1	53·3
3	19·4	4·8	14·6	12·1	3	57	40·5	16·5	48·8	3	59·1	38	21·1	48·6
4	28	−13·7	41·7	7·2	4	60·1	42·4	17·7	51·3	4	57	29·3	27·7	43·2
5	28·9	−7·3	36·2	10·8	5	59·5	32·3	27·2	45·9	5	59	31·4	27·6	45·2
6	34·7	20·2	14·5	27·5	6	56·2	34·8	21·4	45·5	6	59·3	35·2	24·1	47·3
7	40·4	10·8	29·6	25·6	7	55·4	33·5	21·9	44·5	7	50	36·5	13·5	43·3
8	48·8	22·9	25·9	35·9	8	51	29	22	40·0	8	60·4	37·8	22·6	49·1
9	45·3	23	22·3	34·2	9	50·4	30·3	20·1	40·4	9	60·3	44·9	15·4	52·6
10	42	28·8	13·2	35·4	10	52·4	30·3	22·1	41·4	10	66·2	44·2	22	55·2
11	30·7	19·7	11·0	25·2	11	51·1	30·8	20·3	41·0	11	74	39	35	56·5
12	36	10·8	25·2	23·4	12	48·6	33·9	14·7	41·3	12	76·6	42·2	34·4	59·4
13	34·9	14·8	20·1	24·9	13	39	33·1	5·9	36·1	13	72·4	39	33·4	55·7
14	43·1	17·7	25·4	30·4	14	57·9	32·3	25·6	45·1	14	69·6	39·4	30·2	54·5
15	49·1	22·2	26·9	35·7	15	55·7	28·3	27·4	42·0	15	73·4	37·9	35·5	55·7
16	47	39·2	7·8	43·1	16	55·8	39·9	15·9	47·9	16	70·3	40·6	29·7	55·5
17	44	27·3	16·7	35·6	17	52	41·5	10·5	46·8	17	74·3	38	36·3	56·2
18	47·7	25·2	22·5	36·5	18	57·7	37·9	19·8	47·9	18	74·5	37	37·5	55·8
19	53·2	34·7	18·5	44·0	19	53·4	38·7	14·7	46·1	19	72·5	45·2	27·3	58·9
20	61·4	25·3	36·1	43·4	20	58·8	29	29·8	43·9	20	67	39·5	27·5	53·3
21	63	28·3	34·7	45·7	21	52·1	39·3	12·8	45·7	21	65·2	39·8	25·4	52·5
22	55·3	36·7	18·6	46·0	22	48	28·3	19·7	38·2	22	74	50·2	23·8	62·1
23	58·7	26·6	32·1	42·7	23	38	28·2	9·8	33·1	23	65·4	38·3	27·1	51·9
24	60·5	28·5	32	44·5	24	40	29·8	10·2	34·9	24	65·3	47·2	18·1	56·3
25	54	35·9	18·1	45·0	25	46·8	28·1	18·7	37·5	25	60·6	41·2	19·4	55·9
26	49	26	23	37·5	26	47·2	26·3	20·9	36·8	26	65·3	38·7	26·6	52·0
27	46·2	27·4	18·8	36·8	27	48	26·2	21·8	37·1	27	61·1	50·1	11·0	55·6
28	49	27	22	38·0	28	59·5	24·3	35·2	41·9	28	68·3	49·2	19·1	58·8
29	55	19·9	35·4	37·5	29	64·2	27·8	36·4	46·0	29	69·7	41·8	27	55·8
30	60·5	22·2	38·3	41·4	30	69·6	35·9	33·7	52·8	30	55·1	45·8	9·3	50·5
	.....	.....	.....	.....	31	74·4	34·5	39·9	54·5		.....	.....	.....	.....
	1337·7	639·5	698·2	.....		1671·4	1001·5	669·9	.....		1998·2	1206·4	781·8	
	44·6	21·31	23·27	.....		53·91	32·3	21·6	43·11		66·27	40·2	26·06	53·24

1911 BANFF—*Continued.*

Day of Month.	July. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	August. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	September. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.
	°	°	°	°		°	°	°	°		°	°	°	°
1	65·8	46·9	18·9	56·4	1	64·8	44·9	19·9	54·9	1	71·5	38·3	33·2	54·9
2	59·8	48·8	11	54·6	2	62·1	42·9	19·2	52·5	2	71·9	35·7	36·2	53·8
3	59·3	42·7	16·6	51·0	3	64·9	44·9	20	54·9	3	65·4	50·1	15·3	57·8
4	54·3	39·9	14·4	47·1	4	62	42·2	19·8	52·1	4	51	43·3	7·7	47·2
5	69·4	30·5	38·9	50·0	5	54·9	40·8	14·1	47·9	5	47·2	39·7	7·5	43·5
6	73·4	38·3	35·1	55·9	6	53	45·2	7·8	49·1	6	45·8	35·6	10·2	40·7
7	58·8	43·3	15·5	51·1	7	50	43	7	46·5	7	56·3	29	27·3	42·7
8	59·7	39	20·7	49·4	8	51	36·4	14·6	43·7	8	60	38·9	21·4	49·5
9	60·8	45·9	14·9	53·4	9	64	37·7	26·3	50·9	9	61·1	32	29·1	46·6
10	65·4	42·8	22·6	54·1	10	66·6	32·9	33·7	49·8	10	70·7	29·8	40·9	50·3
11	60·9	35·8	25·1	48·4	11	67·4	34·3	33·1	50·9	11	72·2	31·8	40·4	52·0
12	70·1	30·8	39·3	50·5	12	69·5	34·8	34·7	52·2	12	72·4	32·8	39·6	52·6
13	79·3	34·2	45·1	56·8	13	67	36·5	30·5	51·8	13	66·7	46	20·7	56·4
14	84	37·8	46·2	60·9	14	70·8	36·4	34·4	53·6	14	60	46	14	53·0
15	84·3	42·6	41·7	63·5	15	60	37·4	22·6	48·7	15	54·6	38·6	16	46·6
16	83·5	44·2	39·3	63·9	16	67·5	35·8	31·7	51·7	16	48·3	39·7	8·6	44·0
17	77·6	52·1	25·5	64·9	17	73·7	37·8	35·9	55·8	17	51·1	38	13·1	44·6
18	60·8	41·9	18·9	51·4	18	76·2	32·5	43·7	54·4	18	51	35·3	15·7	43·2
19	58·4	40·7	17·7	49·6	19	73·6	36·2	37·4	54·9	19	53·2	33·2	20	43·2
20	74·4	36·2	38·2	55·3	20	58·4	39·3	19·1	48·9	20	51	34·3	16·7	42·7
21	75·5	48·4	27·1	62·0	21	57·9	32·7	25·2	45·3	21	47·3	29·2	18·1	38·3
22	69·9	44·2	25·7	57·1	22	57·2	42·3	14·9	49·8	22	33	26·4	6·6	29·7
23	73·5	37·4	36·1	55·5	23	68·2	31·2	37·0	49·7	23	35·6	25·1	10·5	30·4
24	83·5	42·4	41·1	63·0	24	70·1	33·2	36·9	51·7	24	43·2	18·6	24·6	30·9
25	86·2	42·3	43·9	64·3	25	63·3	41·6	21·7	52·5	25	53·5	23·2	30·3	38·4
26	78·2	47·5	30·7	62·9	26	56·1	39·1	17·0	47·6	26	59·4	25	34·4	42·2
27	68·1	40·3	27·8	54·2	27	68·3	35·9	32·4	52·1	27	54·3	28·2	26·1	41·3
28	73·1	43·8	29·3	58·5	28	67	40·8	26·2	53·9	28	54·1	39·4	14·7	46·8
29	70	48·9	21·1	59·5	29	64·3	45·1	19·2	54·7	29	52·1	34·4	17·7	43·3
30	65·5	39·3	26·2	52·4	30	67	48·8	18·2	57·9	30	48·8	26·4	22·4	37·6
31	68·2	37	31·2	52·6	31	70·4	48·7	21·7	59·6		.....	.....	.....	.....
	2171·7	1285·9	885·8	.....		1987·2	1211·3	775·9	.....		1663·0	1024·0	639	.....
	70·05	41·48	28·57	.....		64·10	39·07	25·02	.....		55·4	34·13	21·3	.....

1911 BANFF—*Concluded.*

Day of Month.	October. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	November. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	December. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.
	°	°	°	°		°	°	°	°		°	°	°	°
1	48·4	26·2	22·2	37·3	1	42·1	6·8	35·3	24·5	1	39·7	29·7	10	34·7
2	46·9	32·7	14·2	39·8	2	45·8	18·9	26·9	32·4	2	37	15·9	21·1	26·5
3	47·5	32·5	15·0	40·0	3	39·4	24·4	15·0	31·9	3	31·2	16	15·2	23·6
4	47·2	28·5	18·7	37·9	4	41·4°	30·9	10·5	36·2	4	33·9	12·4	21·5	23·2
5	51	29·2	21·8	40·1	5	36·2	22·1	14·1	29·2	5	33·2	23·4	9·8	28·3
6	53·9	34	19·9	44·0	6	35·8	22·8	13·0	29·3	6	33	10·2	22·8	21·6
7	64·5	39·2	25·3	51·9	7	31·8	8	23·8	19·9	7	32·2	24·2	8·0	28·2
8	62·4	29·8	32·6	46·1	8	9·5	−42	13·7	2·7	8	36·2	28	8·2	32·1
9	63·4	27·6	35·6	45·5	9	−1·5	−16·3	14·8	−8·9	9	35·0	26·6	9·4	30·8
10	60	31·8	28·2	45·9	10	−8·8	−35·7	26·9	−22·3	10	30	18	12	24·0
11	57·3	27·3	30	42·3	11	0·4	−37·1	37·5	−18·7	11	26·3	6	20·3	16·2
12	60·8	27·2	33·6	44·0	12	1·2	−11·4	12·6	−5·1	12	30·3	22·1	8·2	26·2
13	56·3	31·4	24·9	43·9	13	−8·2	−17·6	9·4	−12·9	13	29	12·7	16·3	20·9
14	51·5	39·8	11·7	45·7	14	19·2	−17·1	36·3	1·1	14	28·3	19·2	9·1	23·7
15	52	35·7	16·3	43·9	15	32·8	17·8	15·0	25·3	15	27	15·9	11·1	21·5
16	53·3	43·6	9·7	48·5	16	30	18·8	11·2	24·4	16	24·2	9·6	14·6	16·9
17	45	26·8	18·2	35·9	17	33·4	24·2	9·2	28·8	17	13	−8·3	21·3	2·4
18	40·2	26·1	14·1	33·2	18	42·3	31·7	10·6	37·0	18	20·8	2·9	17·9	11·9
19	38	17·4	20·6	27·7	19	37	27·7	9·3	32·4	19	22·8	10·9	11·9	16·9
20	43·7	23·8	19·9	33·8	20	35·5	22·8	12·7	29·2	20	26·7	10	16·7	18·4
21	53·8	28·3	25·5	41·1	21	37·3	21·8	15·5	34·6	21	18·9	−0·1	19	9·4
22	49·2	22·3	26·9	35·8	22	31·2	8·8	22·4	20·0	22	36·5	16·8	19·7	26·7
23	39·3	28	11·3	33·7	23	32·9	14·0	18·9	23·5	23	33	11·8	21·2	22·4
24	38·3	23·8	14·5	31·1	24	36·9	20·7	16·2	28·8	24	13	−12·9	25·9	0·1
25	41·6	9·8	31·8	25·7	25	35·8	27·8	8·0	31·8	25	13·4	−12·7	26·1	0·4
26	41·4	6·8	34·6	24·1	26	28·3	8·5	19·8	18·4	26	11·2	−13·3	24·5	−1·1
27	40·5	9	31·5	24·8	27	15	−13·9	28·9	−0·6	27	11·6	−11	22·6	0·3
28	47·9	11	36·9	29·5	28	20·8	0·8	20·0	10·8	28	−8·9	−17·4	8·5	−13·2
29	41·3	10	31·3	25·7	29	25·7	13·3	12·4	19·5	29	−15	−25·7	10·7	−20·3
30	44	11·5	32·5	27·7	30	33·2	20·3	12·9	26·8	30	0·2	−28·8	29	−14·3
31	32·3	15·8	16·5	24·1						31	7·3	−26·3	33·6	−9·5
	1512·7	786·9	725·8	.....		792·4	259·6	532·8	.....		711·0	185·8	525·2	.....
	48·79	25·4	23·4	.....		26·41	8·65	17·76	.....		22·93	5·99	16·94	.....

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CALGARY.

Day of Month.	January. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	February. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	March. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.
	°	°	°	°		°	°	°	°		°	°	°	°
1	2	-16	18	-7	1	21	6	15	13·5	1	48	16	32	32
2	9	-9	18	0	2	34	0	34	17	2	50	32	18	41
3	14	-2	16	6	3	41	15	26	28	3	48	20	28	34
4	14	3	11	8·5	4	40	14	26	27	4	30	20	10	25
5	24	2	22	13	5	49	17	32	33	5	36	16	20	26
6	27	2	25	14·5	6	47	26	21	36·5	6	37	10	27	23·5
7	30	16	14	23	7	30	23	7	26·5	7	44	18	26	31
8	30	16	14	23	8	26	2	24	14	8	34	18	16	26
9	26	12	14	19	9	37	4	33	20·5	9	50	12	38	31
10	26	4	22	15	10	27	20	7	23·5	10	58	40	18	49
11	27	7	20	17	11	30	12	18	21	11	62	37	25	49·5
12	32	5	27	18·5	12	34	4	30	19	12	60	36	24	48
13	36	7	29	21·5	13	18	16	2	17	13	60	26	34	43
14	39	9	30	24	14	0	-2	2	-1	14	62	30	32	46
15	22	12	10	17	15	-2	-17	15	-9·5	15	62	34	28	48
16	33	-2	35	15·5	16	5	-23	28	-9	16	64	29	35	46·5
17	36	7	29	21·5	17	4	-14	18	-5	17	62	32	30	47
18	41	22	19	31·5	18	12	-5	17	3·5	18	62	32	30	47
19	30	22	8	26	19	6	0	6	3	19	59	32	27	45·5
20	34	3	31	18·5	20	-7	-10	3	8·5	20	66	31	35	48·5
21	42	13	29	27·5	21	-12	-18	6	-15	21	67	40	27	53·5
22	40	32	8	36	22	-7	-32	25	-19·5	22	63	31	32	47
23	30	24	6	27	23	4	-25	29	-10·5	23	47	40	7	43·5
24	49	21	28	35	24	0	-15	15	-7·5	24	42	32	10	37
25	40	32	8	36	25	1	-14	15	-6·5	25	48	27	21	37·5
26	37	19	18	28	26	36	-10	46	13	26	52	25	27	38·5
27	45	15	30	30	27	41	20	21	31·5	27	51	36	15	43·5
28	31	24	7	27·5	28	24	16	8	20	28	48	24	24	36
29	40	5	35	22·5						29	48	13	35	30·5
30	50	25	25	37·5						30	56	35	21	45·5
31	28	22	6	25						31	44	27	17	35·5
	964	352	612			539	10	529			1620	851	769	
Mean.	31·09	11·35	19·74		Mean.	19·25	·357	18·89		Mean.	52·26	27·45	24·81	

1910 CALGARY—*Continued.*

Day of Month.	April. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	May. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	June. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.
	°	°	°	°		°	°	°	°		°	°	°	°
1	54	28	26	41	1	53	18	35	35·5	1	60	37	23	48·5
2	46	24	22	35	2	62	22	40	42	2	41	30	11	36·5
3	50	26	24	38	3	65	30	35	47·5	3	56	33	23	44·5
4	59	22	37	40·5	4	69	31	38	50	4	70	37	33	53·5
5	65	22	43	43·5	5	74	36	38	55	5	76	37	39	56·5
6	40	34	6	37	6	77	38	39	57·5	6	77	47	30	62
7	56	22	34	39	7	74	46	28	60	7	60	44	16	52
8	60	26	34	43	8	56	40	16	48	8	66	46	20	56
9	66	28	38	47	9	50	33	17	41·5	9	75	40	35	57·5
10	60	33	27	46·5	10	42	34	8	38	10	84	44	40	64
11	53	35	18	44	11	52	33	19	42·5	11	87	46	41	66·5
12	67	27	40	47	12	70	33	37	51·5	12	64	44	20	54
13	50	32	18	41	13	68	39	23	53·5	13	75	36	39	55·5
14	50	24	16	37	14	54	40	14	47	14	78	42	36	60
15	64	20	44	42	15	54	35	19	44·5	15	83	44	39	63·5
16	64	40	24	52	16	70	26	44	48	16	77	51	26	64
17	63	26	37	44·5	17	74	46	28	60	17	72	52	20	62
18	78	30	48	54	18	51	40	11	45·5	18	72	42	30	67
19	80	36	44	58	19	52	36	16	44	19	79	42	37	60·5
20	57	50	7	53·8	20	58	33	25	45·5	20	72	50	22	61
21	59	25	34	42·5	21	75	32	43	53·5	21	64	47	17	55·5
22	68	29	39	48·5	22	67	47	20	57	22	61	34	27	47·5
23	76	40	36	58	23	75	37	38	56	23	61	46	15	53·5
24	83	40	43	61·5	24	80	40	40	60	24	77	42	35	59·5
25	84	42	42	63	25	80	45	35	62·5	25	84	43	41	63·5
26	58	47	11	52·5	26	70	44	26	57	26	87	44	43	65·5
27	68	28	40	48	27	64	36	28	50	27	83	46	37	64·5
28	48	40	8	44	28	60	33	27	46·5	28	70	50	30	60
29	54	36	18	45	29	70	38	32	54	29	75	48	27	61·5
30	38	31	7	34·5	30	72	37	35	54·5	30	74	48	26	61·0
					31	60	47	13	53·5					
	1818	943	875			1998	1125	873			2160	1292	868	
Mean.	60·6	31·43	29·16		Mean.	64·45	36·29	28·16		Mean.	72·0	43·07	28·93	

1910 CALGARY—*Continued.*

Day of Month.	July. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	August. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	September. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.
	°	°	°	°		°	°	°	°		°	°	°	°
1	74	49	25	61·5	1	72	46	26	59	1	60	42	18	51
2	75	44	31	59·5	2	72	46	26	59	2	70	35	35	52·5
3	74	42	32	58	3	77	41	36	59	3	67	45	22	56
4	77	41	36	59	4	76	44	32	69	4	59	45	14	52
5	78	43	35	60·5	5	54	52	2	53	5	56	45	11	50·5
6	81	44	37	62·5	6	72	50	22	61	6	44	41	3	42·5
7	68	51	17	59·5	7	71	48	23	59·5	7	45	34	11	39·5
8	68	46	22	57	8	79	42	37	60·5	8	47	33	14	40
9	76	44	32	60	9	81	48	23	64·5	9	62	28	34	45
10	66	46	20	56	10	78	50	28	64	10	58	34	24	46
11	79	41	38	60	11	76	46	30	61	11	46	33	13	39·5
12	88	47	41	67·5	12	72	46	26	59	12	60	30	30	45
13	90	52	38	71	13	66	48	18	57	13	62	34	28	48
14	80	54	26	67	14	65	50	15	57·5	14	70	32	38	51
15	83	57	26	70	15	59	42	17	50·5	15	80	44	36	62
16	92	51	41	71·5	16	57	42	15	49·5	16	76	50	26	63
17	88	50	38	69	17	70	36	34	53	17	72	46	26	59
18	80	49	41	64·5	18	76	42	34	59	18	75	43	32	59
19	82	44	38	63	19	84	43	41	64	19	76	44	32	60
20	84	45	39	64·5	20	80	45	35	62·5	20	77	50	27	63·5
21	85	55	30	70	21	72	40	32	56	21	62	46	16	54
22	80	55	25	67·5	22	61	40	21	50·5	22	52	39	13	45·5
23	78	53	25	65·5	23	42	34	8	42	23	60	38	22	49
24	75	42	33	58·5	24	62	30	32	46	24	36	31	5	33·2
25	77	37	40	57	25	68	33	35	50·5	25	54	18	36	36
26	59	43	16	51	26	64	32	32	48	26	66	36	30	41
27	74	35	39	54·5	27	67	36	31	51·5	27	63	38	25	50·5
28	67	48	19	57·5	28	64	40	24	52	28	62	34	28	48
29	74	50	24	62	29	56	41	15	48·5	29	65	39	26	52
30	75	48	27	61·5	30	56	38	18	47	30	59	36	23	47·5
31	78	48	30	63	31	50	44	6	47					
	2405	1454	951			2099	1315	784			1841	1143	698	
Mean.	77·58	46·9	30·68		Mean.	67·71	42·42	25·29		Mean.	61·36	38·1	23·26	

1910 CALGARY—*Concluded.*

Day of Month.	October. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	November. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	December. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.
	°	°	°	°		°	°	°	°		°	°	°	°
1	64	39	25	51·5	1	39	20	19	29·5	1	13	6	7	9·5
2	57	33	24	45·0	2	55	24	31	39·5	2	10	7	3	8·5
3	54	28	26	41	3	32	31	1	31·5	3	11	4	7	7·5
4	52	37	15	44·5	4	38	20	18	29	4	11	5	6	8
5	60	28	32	44	5	47	20	17	28·5	5	20	0	20	10
6	68	34	34	51	6	42	31	11	36·5	6	20	15	5	17·5
7	59	42	17	50·5	7	30	20	10	25	7	39	5	34	22
8	76	34	42	55	8	40	26	14	33	8	40	17	23	28·5
9	52	41	11	46·5	9	22	17	5	19·5	9	34	18	16	24
10	50	38	12	44	10	15	15	10	20	10	27	6	21	16·5
11	48	34	14	41	11	45	21	24	33	11	44	8	36	26
12	48	39	9	43·5	12	45	16	29	30·5	12	46	30	16	38
13	62	28	34	45	13	39	12	27	25·5	13	53	27	26	40
14	64	36	28	50	14	25	17	28	31	14	43	29	14	36
15	75	58	17	66·5	15	42	21	21	31·5	15	44	30	14	37
16	62	42	20	52	16	37	20	17	28·5	16	44	26	18	35
17	44	39	5	41·5	17	47	16	31	31·5	17	38	30	8	34
18	42	34	8	38	18	32	20	12	26	18	48	26	22	37
19	52	22	30	37	19	32	16	16	24	19	51	34	17	42·5
20	58	33	25	45·5	20	30	16	14	21	20	53	33	20	43
21	51	32	19	41·5	21	48	20	28	34	21	38	28	10	33
22	52	31	21	41·5	22	44	26	18	35	22	33	5	28	19
23	49	26	23	37·5	23	38	22	16	30	23	42	19	23	30·5
24	48	33	15	40·5	24	34	18	16	24	24	37	18	19	27·5
25	44	31	13	37·5	25	24	14	10	19	25	41	14	27	27·5
26	38	26	12	32	26	21	18	3	19·5	26	31	24	7	27·5
27	44	12	32	28	27	20	14	6	17	27	21	20	1	20·5
28	59	27	32	43	28	19	12	7	15·5	28	28	5	23	16·5
29	58	36	22	47	29	14	11	3	12·5	29	2	−3	5	−0·5
30	46	26	20	36	30	15	11	4	13	30	1	−7	8	−3·0
31	42	22	20	32						31	−10	−13	3	−11·5
	1678	1021	657			1041	565	476			953	466	487	
Mean.	54·13	32·9	21·19		Mean.	34·7	18·8	15·8		Mean.	30·74	15·03	15·71	

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BANFF.

Day of Month.	January. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	February. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	March. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.
	°	°	°	°		°	°	°	°		°	°	°	°
1	3·8	−32·7	36·5	−14·5	1	22·2	− 4·4	26·6	9	1	39·3	16·2	23·1	27·7
2	− 6·2	−35	28·8	−20·4	2	19·9	− 2·3	22·2	9	2	41·5	32·8	8·7	37·1
3	8·5	−11·1	19·6	− 1·8	3	31·1	14·4	16·7	22·7	3	39·3	30·7	8·6	35·0
4	7·8	−19·6	27·4	− 6	4	30	13·8	16·2	22	4	33·2	27·9	5·3	30·5
5	13·2	− 1	14·2	6	5	28·6	3	25·6	15·8	5	30·2	21	9·2	25·6
6	14	1·2	12·8	7·6	6	28·8	10·4	18·4	19·6	6	31·2	5·7	25·5	18·4
7	15·2	8	7·2	11·6	7	28·3	5·7	22·6	17	7	35·2	24·3	10·9	29·7
8	20·6	5·5	15·1	13	8	22·9	−13·4	36·3	4·7	8	34·2	15·8	18·4	25·0
9	16	− 2·8	18·8	6·6	9	24·9	− 0·1	25	12·4	9	38·7	6	32·7	22·3
10	15·7	− 2·8	18·5	6·4	10	28·2	16·7	11·5	22·3	10	46·2	26·9	19·3	36·5
11	17·6	− 3·1	20·7	7·2	11	26·9	2·2	24·7	14·5	11	48·2	26·1	22·1	37·1
12	22	− 2·3	24·3	10	12	23	− 7·1	30·1	8·0	12	50·1	42·1	8·0	46·1
13	23·2	2·4	20·8	12·8	13	19	11	8	15	13	53·1	22·2	30·9	37·6
14	23	6·3	16·7	14·6	14	14·2	− 1	15·2	6·6	14	52·9	22	30·9	37·4
15	22·2	12	10·2	17·1	15	3·2	−15·1	18·3	− 6	15	52·6	18·4	34·2	35·5
16	16·6	− 8·7	25·3	4·1	16	8·5	−26·5	35	− 9·5	16	52·7	19·3	33·4	36·0
17	23·5	10·9	12·6	16·9	17	15	− 0·7	15·7	7	17	49·1	26	23·1	37·6
18	35·3	19·2	16·1	27·2	18	15·8	−17·6	33·4	− 1·1	18	49·3	36	13·3	42·6
19	31·4	18·3	13·1	24·8	19	13·8	− 6·9	20·7	3·4	19	53·3	25·1	28·2	39·2
20	27·8	15·3	12·5	21·5	20	5·5	−11	16·5	− 3	20	50·8	30·3	20·5	40·5
21	30·8	17·8	13·0	24·3	21	− 5·8	−21·6	15·8	− 3·7	21	53·2	34·3	18·9	43·7
22	41·9	36·4	15·5	34	22	0·1	−30·4	30·5	−15·2	22	52·8	29·8	23·0	41·3
23	43·9	34·5	9·4	39·2	23	14·4	−10	24·4	− 2·2	23	48	30·3	17·7	39·1
24	41·7	33·8	7·9	37·7	24	20	1·0	19	10·5	24	36·3	29·4	6·9	32·7
25	39·3	25·7	13·6	32·5	25	28·3	− 2·9	31·2	12·7	25	38·9	20·7	18·2	29·8
26	27·3	13·9	13·4	20·6	26	26·8	− 2·1	28·9	12·3	26	38·2	29·4	8·8	33·8
27	29·8	21·7	8·1	25·7	27	32	23·4	8·6	27·7	27	39·8	25·1	14·7	32·4
28	28	18·9	9·1	23·4	28	28·2	8·4	19·8	18·3	28	37·9	24·8	13·1	31·3
29	30·2	3·6	26·6	17						29	38·8	21·2	17·6	30·0
30	37·2	24·2	13	30·7						30	42·1	33	9·1	37·5
31	32·8	21·3	11·5	27·0						31	38·1	19·6	18·5	28·8
	734·1	221·8	512·3			553·8	−63·1	616·9			1,345·2	772·4	572·8	
Mean	23·68	7·15	16·52		Mean	19·77	−2·25	22·03		Mean	43·39	24·91	18·47	

1910 BANFF—*Continued.*

Day of Month.	April. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	May. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	June. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.
	°	°	°	°		°	°	°	°		°	°	°	°
1	43	18·9	24·1	31	1	47·9	18·3	29·6	33	1	59	36·4	22·6	47·7
2	37	26·1	10·9	31·6	2	54·9	22·4	32·5	38·6	2	42·6	29·3	13·3	35·9
3	39·3	12·9	26·4	26·1	3	59·9	23·9	36·0	42	3	54·5	30·7	23·8	42·6
4	42·3	27·9	14·4	35·1	4	65·5	26·9	38·6	46·2	4	66·5	33·9	32·6	50·2
5	41·1	33·5	7·6	37·3	5	71·3	30·1	41·2	50·7	5	70·1	32·3	37·8	51·2
6	40·9	32·7	8·2	36·8	6	67·8	34·1	33·7	51	6	67·2	41·7	25·5	54·5
7	40	25·8	14·2	32·9	7	67	40·1	26·9	53·5	7	56	33·9	22·1	45·0
8	46·3	29·8	16·5	38	8	60·8	39·3	21·5	50	8	62·4	39·8	22·6	51·0
9	53·8	29·2	24·6	41·5	9	56·9	27·3	29·6	42	9	61·3	35·2	26·1	48·3
10	57	29·9	27·1	43·5	10	45·3	33·2	12·1	39·2	10	77	41·8	35·2	59·4
11	56·9	34·7	22·2	45·8	11	60·8	29·3	31·5	45	11	76·5	48·8	37·7	57·6
12	52·4	31·8	20·6	42·1	12	58·7	36·9	21·8	47·3	12	56·3	43·3	13·0	49·8
13	43·3	29·4	13·9	36·3	13	58·4	34·7	23·7	46·5	13	66·3	43·3	23·0	54·8
14	41·1	18·4	22·7	29·7	14	50·2	34·3	15·9	42·2	14	70·4	33·5	36·9	52·0
15	53·3	24·7	28·6	39	15	50·9	30·4	20·5	40·6	15	74·2	42·2	32·0	58·2
16	56·4	35·1	21·3	45·7	16	60·9	27·9	33·0	44·4	16	70	37	33·0	53·5
17	59	28·8	30·2	44	17	61·8	45	16·8	53·4	17	60·2	45	15·2	52·6
18	61·1	31·6	29·5	46·3	18	56·2	37·2	19·0	46·7	18	59·7	40·2	19·5	49·9
19	65·4	32·7	32·7	49	19	47·7	32·4	15·3	40	19	68·2	36	32·2	52·1
20	63·8	39·3	24·5	51·5	20	53·8	32·2	21·6	43	20	60·3	44·5	15·8	52·4
21	48·9	31·2	17·7	40	21	66·5	28·3	38·2	47·4	21	53·9	38	15·9	46·0
22	59	37·7	21·3	48·3	22	71·5	37·9	33·6	54·7	22	61·3	32	29·3	46·6
23	69·5	31·1	38·4	50·3	23	75·6	31·6	44·0	53·6	23	58·3	32	26·3	44·2
24	72·6	37·3	35·3	55·0	24	75·6	36·7	38·9	56·1	24	68·6	35	33·6	51·8
25	75·4	30·5	44·9	53·0	25	73·3	44·4	28·9	58·8	25	74	40·5	33·5	57·3
26	72·8	33·3	39·5	53	26	58	41·2	16·2	49·3	26	75·4	40·2	35·2	57·8
27	63	36·4	26·6	49·7	27	53·2	37·2	16·0	45·2	27	75	36·8	38·2	55·9
28	54·3	33·6	20·7	44·0	28	57·1	28·8	28·3	42·9	28	71·2	41·9	29·3	56·6
29	44·5	31·9	12·6	38·2	29	62·5	42·2	20·3	52·3	29	66·0	41·0	25·0	53·5
30	42·8	30·2	12·6	36·5	30	61·4	30·9	30·5	46·1	30	64·7	40·5	24·2	52·6
					31	60·2	41·9	18·3	51·0					
	1,596·2	906·4	689·8			1,871·6	1,037·0	834·6			1,947·1	1,136·7	810·4	
Mean	53·20	30·21	22·99		Mean	60·37	33·45	26·92		Mean	64·9	37·8	27·0	

1910 BANFF—*Continued.*

Day of Month.	July. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	August. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	September. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.
	°	°	°	°		°	°	°	°		°	°	°	°
1	67·0	42·8	24·2	55·0	1	73	36·7	36·3	54·9	1	59·4	40·1	19·3	49·7
2	63	34·5	28·5	48·8	2	70·1	39·7	30·4	54·9	2	64·6	31	33·6	47·8
3	63·2	36	27·2	49·6	3	73·3	39·9	33·4	56·6	3	58·3	46·7	11·6	52·5
4	68·3	36·5	31·8	52·4	4	73·2	40·5	32·7	56·8	4	58·2	42·8	15·4	50·5
5	72·7	34·8	37·9	53·8	5	51·2	40·1	11·1	45·7	5	56·3	40·2	16·1	48·3
6	70·9	45·5	25·4	58·2	6	67·2	41·7	25·5	54·5	6	45	38·2	6·8	41·6
7	67	52·2	14·8	59·6	7	71·2	39·5	31·7	55·4	7	40·3	32·8	7·5	36·6
8	69	40·8	28·2	54·9	8	76·1	38·2	37·9	57·2	8	39·7	31·3	8·4	35·5
9	74·7	36·8	37·9	55·6	9	74·4	42	32·4	58·2	9	56·1	25	31·1	40·6
10	70	43·5	26·5	56·7	10	72	43·5	28·5	57·8	10	53·3	29·2	24·1	41·3
11	79·4	39·8	39·6	59·6	11	72·9	42·3	30·6	57·6	11	48·3	31·2	17·1	39·7
12	84	41·2	42·8	47·6	12	70·6	40·3	30·3	55·5	12	56	24·3	31·7	40·2
13	80	47·8	32·2	63·9	13	63·2	45·7	17·5	54·5	13	60·5	25·2	35·3	42·8
14	81·4	46	35·4	63·7	14	55·2	43·1	12·1	49·2	14	73·5	26·8	46·7	50·2
15	76·9	52·2	24·7	64·6	15	59	42·3	16·7	50·6	15	72·6	30·8	41·8	51·7
16	85	44·3	40·7	64·7	16	57	32·2	24·8	44·6	16	73	36·8	36·2	54·9
17	84·9	45·9	39·0	65·4	17	67·4	32·8	34·6	50·1	17	70·5	38·9	31·6	54·7
18	80·2	46·7	33·5	63·4	18	72·5	34	38·5	53·2	18	72·4	38·8	33·6	55·6
19	83·4	37·3	46·1	60·4	19	76·4	39·5	36·9	58·0	19	76·3	35·5	40·8	55·9
20	84·6	39	45·6	61·8	20	73·6	57·8	15·8	65·7	20	77·4	33·9	43·5	55·7
21	82·5	41·6	40·9	62·1	21	68·8	41·3	27·5	55·1	21	70·4	34·4	36·0	52·4
22	75·2	49·3	25·9	62·3	22	60·2	43·8	16·4	52·0	22	61·4	38·8	22·6	50·1
23	69·5	48·2	21·3	58·9	23	54·4	32·8	21·6	43·6	23	58	39·3	18·7	48·6
24	67·1	50·8	16·3	59·0	24	54·4	26	28·4	40·2	24	39·8	28·3	11·5	34·1
25	72·2	33·9	38·3	53·1	25	65·2	29·3	35·9	47·3	25	53·2	21·6	31·6	37·4
26	68·9	44·8	24·1	56·8	26	61·9	28·5	33·4	45·2	26	54·4	39·2	15·2	46·8
27	73·5	34·3	39·2	53·9	27	64·4	28·4	36·0	46·8	27	58	32·3	25·7	45·1
28	68·4	40·1	28·3	54·2	28	60·2	33·8	26·4	47·0	28	53·3	43·5	9·8	48·4
29	71·4	44·3	27·1	57·8	29	55·3	37·9	17·4	46·6	29	50·9	39·9	11·0	45·4
30	77	41	36	59·0	30	56·2	38·3	17·9	47·2	30	48·5	36·4	12·1	42·5
31	75·9	43	32·9	59·5	31	50·8	41·9	8·9	46·3					
	2,307·2	1,315	992·3			2,021·3	1,193·8	827·5			1,759·6	1,033·2	726·4	
Mean	74·42	42·42	32·00		Mean	65·20	38·51	26·69		Mean	58·65	34·44	24·21	

1910 BANFF—*Concluded.*

Day of Month.	October. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	November. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.	Day of Month.	December. Temperature. Max.	Min.	Daily Range.	Mean Daily Temp.
	°	°	°	°		°	°	°	°		°	°	°	°
1	48	36·2	11·8	42·1	1	39·2	21·2	18	30·2	1	33·8	15·2	18·6	24·5
2	46·3	31	15·3	38·7	2	43·8	32·8	11	38·3	2	33·7	8·2	25·5	21·0
3	44·1	34·3	9·8	39·2	3	37	27·4	9·6	32·2	3	13·2	1·8	11·4	7·5
4	46·7	33·9	12·8	40·3	4	37	20·	17	28·5	4	34·3	2·2	32·1	18·3
5	50·7	35	15·7	42·8	5	38	29·7	8·3	33·9	5	27·9	6·9	21·0	17·4
6	49·2	38·7	10·5	44·0	6	39·2	30·8	8·4	35·0	6	26·5	11·5	15	19·0
7	49·5	38·3	11·2	43·9	7	44·5	30·8	13·7	37·6	7	33·7	15·4	18·3	24·6
8	59·9	37·6	22·3	48·8	8	44·4	28·2	16·2	36·3	8	32·7	25·2	7·5	28·9
9	59·4	41·8	17·6	50·6	9	32	20·5	11·5	26·2	9	29	22·3	6·7	25·6
10	42·2	34·8	7·4	38·5	10	35	20·5	14·2	27·9	10	23·1	7·9	15·2	15·5
11	44	34·3	9·7	39·2	11	38·3	31·8	6·5	35·1	11	29·2	5·9	23·3	17·6
12	50·1	38	12·1	44·1	12	34·2	14·6	19·6	24·4	12	42·2	24·2	18	33·2
13	55·1	31·7	23·4	43·4	13	30·3	13·5	16·8	21·9	13	41	30·8	10·2	35·9
14	54·5	46·5	8·0	50·5	14	34·2	22·1	12·1	28·2	14	35	18·5	16·5	26·8
15	62·5	49·8	12·7	56·1	15	32·7	11·6	21·1	22·1	15	30·3	18	12·3	24·2
16	61·3	32·9	28·4	47·1	16	29·1	9·6	19·5	19·4	16	31·2	20·3	10·9	25·7
17	56·3	35·2	21·1	45·8	17	30·7	18·7	12	24·7	17	29·8	16	13·8	22·9
18	41·2	32·9	8·3	37·1	18	28·3	18·3	10	23·3	18	35·3	16	19·3	25·6
19	48·8	24·6	24·2	36·7	19	32·7	23·8	8·9	28·3	19	33·2	19·6	13·6	26·4
20	52·7	34·6	18·5	43·5	20	35·4	25·1	10·3	30·3	20	31·7	19·1	12·6	25·4
21	54·9	30·6	24·3	47·8	21	36·8	32·1	4·7	34·4	21	31·1	20·8	10·3	26·0
22	51	41·4	9·6	46·2	22	34·7	27·2	7·5	30·9	22	21·6	6·1	15·5	13·9
23	42·3	33·3	9·0	37·8	23	32·6	19·4	13·2	26·0	23	26·1	18·2	7·9	22·2
24	41	32·4	8·6	36·7	24	29	9·3	19·7	19·2	24	28·6	21·7	6·9	25·2
25	41	31·5	9·5	36·3	25	14·8	− 8	22·8	3·4	25	30·8	15·8	15	23·3
26	33·3	21	12·3	27·2	26	19·3	0·8	18·5	10·1	26	30	25·3	4·7	27·6
27	36·1	7·7	28·4	21·9	27	18·2	3·4	14·8	10·8	27	26·3	11·2	15·1	18·8
28	44·1	23·5	20·6	33·8	28	22·8	5·6	17·2	14·2	28	26·3	11·2	15·1	18·8
29	50·3	37	13·3	43·7	29	21·3	5·7	15·6	13·5	29	28·6	20·1	8·7	24·4
30	46·8	26·3	20·5	36·6	30	17·2	8·6	8·6	12·9	30	28·9	13·2	15·7	21·1
31	42·8	29·3	13·5	36·1						31	13	−14·5	27·5	− 0·7
	1,506·1	1,053·7	470·4			962·7	555·4	407·3			918·1	454·1	464	
Mean	48·58	33·4	15·17		Mean	32·09	18·51	13·58		Mean	29·61	14·64	14·97	

APPENDIX X.

EVAPORATION DATA.

OBSERVATION OF EVAPORATIONS.

Station No. 1.—Calgary. (Pan in water.) 1896.

Interval, 1896.	Excess of Evaporation over Precipitation.	Excess of Precipitation over Evaporation.	Precipitation.	Total Evaporation.
	Inches.	Inches.	Inches.	Inches.
May 18 - May 29	1·626		0·46	2·086
May 29 - June 29	3·354		1·22	4·574
June 29 - July 30	1·704		1·84	3·544
July 30 - Aug. 31	1·188		1·66	2·848
Aug. 31 - Sept. 29	1·200		1·46	2·660
Sept. 29 - Oct. 23	1·224		0·70	1·924
Totals	10·296		7·34	17·636

Station No. 2.—Calgary. (Pan in ground.) 1896.

Interval, 1896.	Excess of Evaporation over Precipitation.	Excess of Precipitation over Evaporation.	Precipitation.	Total Evaporation.
	Inches.	Inches.	Inches.	Inches.
May 21 - May 28	0·894		0·46	1·354
May 28 - June 29	3·060		1·22	4·280
June 29 - July 27	2·148		1·84	3·988
July 27 - Aug. 31	1·284		1·66	2·944
Aug. 31 - Sept. 29	0·900		1·46	2·360
Sept. 29 - Oct. 23	3·312		0·70	4·012
Totals	11·598		7·34	18·938

Taken from Report on Irrigation Surveys, 1896, 1897, 1898, by J. S. Dennis.

Station No. 1.—Rating Station Calgary. (Pan submerged.) 1896

Date, 1896.	Gauge Readings.		Difference in Feet.	
	At Date.	Previous.	Plus.	Minus.
May 18	0·2145	0·2145		
21	0·2405	0·2145	·0260	
25	0·1790	0·2405		·0615
29	0·0790	0·1790		·1000
June 1	0·0615	0·0790		·0175
4	0·0096	0·0615		·0519
8	0·0015	0·0096		·0081
8	0·417	0·417		
11	0·429	0·417	·012	
15	0·371	0·429		·058
18	0·352	0·371		·019
22	0·281	0·352		·071
25	0·2755	0·281		·0055
29	0·215	0·2755		·0605
July 2	0·254	0·215	·039	
6	0·209	0·254		·045
9	0·231	0·209	·022	
13	0·152	0·231		·079
16	0·133	0·152		·019
20	0·100	0·133		·033
23	0·090	0·100		·010
27	0·053	0·090		·037
30	0·073	0·053	·020	
Aug. 3	0·030	0·073		·043
6	0·059	0·030	·029	
11	0·096	0·059	·037	
13	0·093	0·096		·003
15	0·043	0·093		·051
20	0·069	0·042	·027	
24	0·022	0·069		·047
27	0·017	0·022		·005
31	0·609	0·652		·043
Sept. 3	0·582	0·609		·027
7	0·566	0·582		·016
13	0·578	0·566	·012	
17	0·584	0·578	·006	
21	0·550	0·584		·034
25	0·551	0·550	·001	
29	0·509	0·551		·042
Oct. 5	0·443	0·509		·066
12	0·474	0·443	0·031	
15	0·437	0·474		·037
19	0·419	0·437		·018
23	0·407	0·419		·012
Nov. 8	0·417	0·407	·010	
Total			·2720	1·1200

Station No. 2.—Calgary. (Pan in ground.) 1896.

Date, 1896.	Gauge Readings.		Difference in Feet.	
	At Date.	Previous.	Plus.	Minus.
May 21	1·6305			
25	1·5905	1·6305		·040
28	1·5640	1·5905		·0345
June 1	1·5250	1·5640		·0390
4	1·4970	1·5250		·0280
8	1·5040	1·4970	·007	
11	1·488	1·5040		·016
15	1·449	1·488		·039
18	1·417	1·449		·032
22	1·357	1·417		·060
25	1·348	1·357		·009
29	1·309	1·348		·039
July 2	1·347	1·309	·038	
6	1·305	1·347		·042
9	1·295	1·305		·010
13	1·246	1·295		·049
16	1·208	1·246		·038
20	1·166	1·208		·042
23	1·160	1·166		·006
27	1·130	1·160		·030
Aug. 3	1·109	1·130		·021
6	1·147	1·109	·038	
11	1·105	1 147		·042
13	1·091	1·105		·014
18	1·069	1·091		·022
20	1·105	1·069	·036	
24	1·080	1·105		·025
27	1·059	1·080		·021
31	1·023	1·059		·036
Sept. 3	0·9925	1·023		·0305
7	0·977	0·9925		·0155
13	1·000	0·977	·023	
17	0·995	1·000		·005
21	0·994	0·995		·001
24	0·976	0·994		·018
29	0·948	0·976		·028
Oct. 5	0·912	0·948		·036
12	0·708	0·912		·204
15	0·698	0·708		·010
19	0·683	0·698		·015
23	0·672	0·683		·011
Nov. 8	0·901	0·672	·229	
			·371	1·1085

Station No. 1.—Calgary. (Pan submerged). 1897.

Date 1897.	Gauge Readings.		Difference in Feet		General Remarks.
	At Date.	Previous.	Gain.	Loss.	
May 1	0·0253	0·0253			Initial reading.
" 8	0·0163	0·0253		0·0090	
" 15	0·0061	0·0163		0·0102	
" 22	0·0069	0·0061	0·0008		Very windy.
" 29	0·0001	0·0069		0·0068	
June 5	0·0001	0·0001			Before refilling.
" 5	0·0377	0·0377			After refilling.
" 12	0·0466	0·0377	0·0089		Very windy.
			0·0097	0·0260	

Total evaporation to June 5, 0·0260 feet.

Station No. 2.—Calgary. (Pan in ground. 1897.

Date, 1897.	Gauge Readings.		Difference in Feet.		Remarks.
	At Date.	Previous.	Gain.	Loss.	
May 1	0·0599	0·0599	.....	.....	
" 8	0·0549	0·0599	.....	0·0050	Before refilling.
" 8	0·0875	0·0875	.....	.....	After refilling.
" 15	0·0821	0·0875	.....	0·0054	
" 22	0·0751	0·0821	.....	0·0070	
" 29	0·0693	0·0751	.....	0·0058	
June 5	0·0660	0·0693	.....	0·0033	
" 12	0·0710	0·0660	0·0050	.....	Very windy.
	.....	.....	0·0050	0·0265	

Total evaporation to June 5, 0·0265 feet.

Station No. 1.—Calgary. (Pan in ground.) 1898.

Interval, 1898.	Excess of Evaporation over Precipitation.	Excess of Precipitation over Evaporation.	Precipitation	Total Evaporation.
	Inches.	Inches.	Inches.	Inches.
June 8-June 29	0·792	.....	3·21	4·002
June 29-July 31	2·604	.....	3·87	6·474
July 31-Aug. 30	2·160	.....	2·17	4·330
Aug. 30-Sept. 30	2·688	.....	0·54	3·228
Sept. 30-Oct. 31	6·576	.....	0·28	6·856
Oct. 31-Nov. 5	0·372	.....	0·00	0·372
Totals	15·192	.....	10·07	25·262

Station No. 1.—Calgary. (Pan in ground.) 1899

Interval, 1899.	Excess of Evaporation over Precipitation.	Excess of Precipitation over Evaporation.	Precipitation.	Evaporation.
	Inches.	Inches.	Inches.	Inches.
April 13-May 1	1·140	.....	0·05	1·190
May 1-May 31	.....	3·696	5·44	1·744
May 31-June 30	1·380	.....	3·52	4·900
June 30-July 31	2·376	.....	2·11	4·486
July 31-Aug. 31	.....	5·876	9·40	3·524
Aug. 31-Sept. 30	2·160	.....	0·99	3·150
Sept. 30-Oct. 31	.....	0·192	1·31	1·118
Oct. 31-Nov. 30	0·192	.....	0·26	0·452
Totals	7·248	9·764	23·08	20·564

Station No. 1.—Calgary. (Pan in ground.) 1900.

Interval, 1900.	Excess of Evaporation over Precipitation.	Excess of Precipitation over Evaporation.	Precipitation.	Total Evaporation.
	Inches.	Inches.	Inches.	Inches.
Apr. 1-Apr. 30	0·372	.....	2·04	2·412
Apr. 30-May 31	2·724	.....	1·32	4·044
May 31-June 30	1·032	.....	3·56	4·592
June 30-July 31	2·424	.....	2·02	4·444
July 31-Aug. 31	2·400	.....	1·29	3·690
Aug. 31-Sept. 30	.....	3·024	3·99	0·966
Sept. 30-Oct. 31	0·108	.....	0·40	0·508
Oct. 31-Nov. 14	0·504	.....	0·00	0·504
Totals	9·564	3·024	.....	21·160

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DEPARTMENT OF THE INTERIOR, CANADA
WATER POWER BRANCH
J. B. CHALLIES, Superintendent

WATER RESOURCES PAPER No. 8

REPORT

OF THE

BRITISH COLUMBIA HYDROGRAPHIC SURVEY

FOR

THE CALENDAR YEAR 1913

BY

R. G. SWAN, A.M. Can. Soc. C.E.
Chief Engineer.

OTTAWA
PRINTED BY J. DE L. TACHÉ, PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1915

25F—1915] 1½

To Field Marshal, His Royal Highness Prince Arthur William Patrick Albert, Duke of Connaught and of Strathearn, K.G., K.T., K.P., etc., etc., etc., Governor General and Commander in Chief of the Dominion of Canada.

May it Please Your Royal Highness:

The undersigned has the honour to lay before Your Royal Highness the British Columbia Hydrographic Survey Report for 1913.

Respectfully submitted,

W. J. ROCHE,
Minister of the Interior.

Ottawa, July 1, 1914.

Department of the Interior,

Ottawa, July 1, 1914.

The Honourable W. J. Roche, M.D.,
Minister of the Interior.

Sir,—I have the honour to submit the British Columbia Hydrographic Survey Report for 1913, and to recommend that it be published as Water Resources Paper No. 8 of the Dominion Water Power Branch.

I have the honour to be, sir,

Your obedient servant,

W. W. CORY,
Deputy Minister of the Interior.

Department of the Interior,

Water Power Branch,

Ottawa, July 1, 1914.

W. W. Cory, Esq., C.M.G.,
Deputy Minister of the Interior.

Sir,—I have the honour to submit the attached report by R. G. Swan, A.M. Can. Soc. C.E., Chief Engineer of the British Columbia Hydrographic Survey.

In view of its important bearing on the industrial development of Southern British Columbia I would recommend that it be published as Water Resources Paper No. 8 of the Dominion Water Power Branch.

Respectfully submitted,

J. B. CHALLIES,
Superintendent, Dominion Water Power Branch.

Ottawa, July 1, 1914.

J. B. Challies, Esq.,
Superintendent,
Dominion Water Power Branch,
Department of the Interior,
Ottawa.

Sir,—I have the honour to submit a brief report of the British Columbia Hydrographic Survey for the year 1913, together with the reports of the divisional engineers.

Allowance should be made for the fact that the reorganization, following the agreement between yourself and Mr. Wm. Young, Comptroller of Water Rights Victoria, B.C., regarding the gradual extension of territory of the Hydrographic Survey work by the Dominion Government from the Railway Belt to cover the entire province is still in progress. This agreement was only finally effected in September last by the formal approval of both Governments.

I have the honour to be, sir,

Your obedient servant,

R. G. SWAN,
Chief Engineer.

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REPORT

OF

BRITISH COLUMBIA HYDROGRAPHIC SURVEY FOR 1913

CHAPTER I

REPORT OF R. G. SWAN, A.M. Can. Soc. C.E.
Chief Engineer.

CHAPTER I.

REPORT OF THE CHIEF ENGINEER.

ORGANIZATION.

The personnel of the staff for 1913 was as follows:—

P. A. Carson, B.A., D.L.S., Chief Engineer (resigned July 31, 1913).
R. G. Swan, A.M. Can. Soc. C.E., Assistant Chief Engineer, June 1 to September 30; Chief Engineer, October 1.
E. M. Dann, D.L.S., Divisional Engineer.
C. G. Cline, Jr. Can. Soc. C.E., D.L.S., Divisional Engineer.
C. E. Richardson, A.M. Can. Soc. C.E., Divisional Engineer.
K. G. Chisholm, Assistant Engineer.
H. J. E. Keys, B.A. Assistant Engineer.
C. E. Webb, Assistant Engineer, from October 28, 1913.
J. A. Elliott, summer assistant (May 4 to September 17, 1913).
H. C. Hughes, summer assistant (May 13 to August 23, 1913).
A. T. Milner, clerical assistant from August 27, 1913.
Miss B. B. Allan, stenographer.
Miss W. M. Robinson, stenographer, from November 15, 1913.

The organization for the first nine months of the year was very similar to that of previous years and, although the work was still confined to the Railway Belt, a large number of new stations were established.

The Railway Belt at this time was divided into three divisions; Messrs. Cline and Chisolm were in charge of the district from the coast east to Deadman river; for five months during the summer period, Mr. Hughes was stationed at Indian river, rating the stations on the different streams in connection with the proposed development of the New Westminster Power Co. Mr. Keys was in charge of the district extending from the Deadman river east to grand Prairie; Mr. Richardson was in charge of the district from Grand Prairie to the eastern boundary of the province, with Mr. Elliott as a summer assistant on account of the large number of new stations established in this division.

Owing to Mr. Carson's frequent absences on inspection trips, Mr. Dann was stationed in the head office at Kamloops, having charge of the office from the first of the year until Mr. Carson's resignation. Mr. Dann was also in charge of special work in regard to streams tributary to the Shuswap lakes.

NATURE AND EXTENT OF WORK.

CHANGE IN WORK DUE TO THE AMENDMENT OF THE WATER ACT ASSENTED TO 6TH JUNE, 1913.

With the passing of the amendment to the Water Act the administration of all water within the Railway Belt passed under the exclusive control of the province of British Columbia, and the investigation into the water rights situation in the dry belt was carried on by the district engineers of the Water Rights Branch, Department of Lands, Victoria, B.C., thus allowing the Hydrographic Survey staff greater time for the extension of the study of the water supply and resources of the Railway Belt. For the same reason it has been possible to carry on the inspection of land applications under irrigation and reclamation conditions, and applications for foreshore rights, in a much more thorough manner than heretofore.

NEW WORK ENTERED INTO IN NEW DIVISIONS.

Following the agreement between yourself and Mr. Wm. Young, Comptroller of Water Rights, Department of Lands, Victoria, B.C., regarding the extension of territory of the Railway Belt Hydrographic Survey so that it will ultimately cover the entire province, and which agreement was finally given effect in September by the formal approval of both Governments, the following changes have been made in the organization of the work.

The title of the work has been changed from the "Railway Belt Hydrographic Survey" to the "British Columbia Hydrographic Survey," and the office of the chief engineer has been removed from Kamloops to Vancouver. The territory of the province has been divided for the present into three main divisions, with headquarters at Kamloops, New Westminster, and Nelson, where permanent office quarters have been provided for the division engineers of the respective divisions, namely, Mr. E. M. Dann, D.L.S., Mr. C. E. Richardson, A.M. Can. Soc. C.E., and Mr. C. G. Cline, Jr. Can. Soc. C.E., D.L.S.

In making the division of the province the mountain divides were followed, and the drainage areas, where possible, were kept intact.

Many new conditions arising from all these changes have affected the efficiency and effectiveness of our work and, owing to the lack of funds, very little new work has been undertaken except at the request of Mr. Young and co-operating parties. Now that the various division offices are becoming well organized, a good year's work should be accomplished if the staff required is made available.

COAST DIVISION.

C. G. Cline, Divisional Engineer.

At the request of the Bridge River Power Co., the maintenance of the station established by them on the Bridge river has been taken over by the survey.

As the province are making extensive surveys with regard to storage possbiilities for the water supply of Greater Vancouver, stations were established on Lynn, Capilano, and Seymour rivers.

In Pemberton Meadows, surveys are being made in connection with a project covering the drainage of land through which the Lillooet river flows and, as it is necessary to provide for the control of this river, a station was established. On Green and Cheakamus rivers there are good power possibilities and, as there have been several requests for data on these rivers, gauging stations were established at the same time as the station on the Lillooet river.

KAMLOOPS DIVISION.

E. M. Dann, Divisional Engineer.

By the time the arrangements for enlarging the work were completed, the season was so far advanced that it was practically impossible for Mr. Dann to establish any new stations in his division. He has, however, covered most of this territory, and will be able to make a vigorous start on this work in the spring. Many of the irrigation streams in the division are over-recorded, so that a very thorough study of the run-off must be made.

NELSON DIVISION.

C. E. Richardson, Divisional Engineer.

Previous to the time of the reorganization, Mr. Richardson's work in British Columbia had extended outside the Railway Belt. He had made several

trips with Mr. Biker, the Provincial Engineer, through the country in the vicinity of Nelson in connection with the proposed McKay reclamation scheme on the Upper Columbia, which required the establishment of several stations on the rivers tributary to the Columbia in the Windermere district, and as a result Mr. Richardson was familiar with a large part of this division before his transfer to Nelson.

During the fall, stations were established on the Columbia, Pend d'Oreille, Elk Bull, and Kootenay (two stations) rivers.

METERING STATIONS.

The following lists give: first, the regular metering stations; and second, rivers on which miscellaneous measurements have been made.

Coast Division.—List of Regular Metering Stations.

No. of Station.	River.	Location.
1000	Belknap creek at Belknap lake	Tp. 6, R. 7, W. 7 M.
1001	Boulder creek	Tp. 3, R. 27, W. 6 M.
1002	Brandt creek lower	Tp. 7, R. 7, W. 7 M.
1003	Chehalis river	Tp. 4, R. 30, W. 6 M.
1004	Chilliwack river	Tp. 23, E. C. M.
1005	Coquihalla river	Tp. 5, R. 26, W. 6 M.
1006	Coquitlam river	Tp. 5, R. 6, W. 7 M.
1007	Fraser river	Tp. 5, R. 26, W. 6 M.
1008	Gold creek	Tp. 39, W. C. M.
1009	Hixon creek, near mouth	Tp. 6, R. 7, W. 7 M.
1010	Jones creek	Tp. 3, R. 27, W. 6 M.
1011	Mesliloet river	Tp. 7, R. 7, W. 7 M.
1012	North Lillooet river	Tp. 12, E. C. M.
1013	Norton creek	Tp. 7, R. 7, W. 7 M.
1014	Rainbow creek	Tp. 6, R. 4, W. 7 M.
1015	Raven (Rushton) creek	Tp. 5, R. 4, W. 7 M.
1016	Silver creek (near Hope)	Tp. 5, R. 26, W. 6 M.
1017	Silver creek (tributary Pitt river)	Tp. 4, R. 5, W. 7 M.
1018	South Lilloooet river	Tp. 12, E. C. M.
1019	Stave river	Tp. 4, R. 3, W. 7 M.
1020	Young creek	Tp. 7, R. 7, W. 7 M.
1021	Brandt creek, upper	Tp. 7, R. 7, W. 7 M.

Kamloops Division.—List of Regular Metering Stations.

No. of Station.	River.	Location.
2000	Adams river	Tp. 23, R. 12, W. 6 M.
2001	Barnes creek	Tp. 20, R. 24, W. 6 M.
2002	Bolean creek	Tp. 18, R. 12, W. 6 M.
2003	Bonaparte river	Tp. 21, R. 24, W. 6 M.
2004	Campbell creek	Tp. 19, R. 16, W. 6 M.
2005	Cherry creek	Tp. 19, R. 19, W. 6 M.
2006	Coldwater river, Merritt	Water District No. 3.
2007	Criss creek	Tp. 22, R. 22, W. 6 M.
2008	Deadman river	Tp. 22, R. 22, W. 6 M.
2009	Deadman river	Tp. 21, R. 22, W. 6 M.
2010	Eagle river	Tp. 23, R. 6, W. 6 M.
2011	Essell creek	Tp. 17, R. 14, W. 6 M.
2012	Fraser river	Tp. 15, R. 27, W. 6 M.
2013	Greenstone creek	Tp. 17, R. 20, W. 6 M.
2014	Guichon creek, Mamit lake	Water District No. 3.
2015	Hat creek	Tp. 22, R. 25, W. 6 M.
2016	Hat creek	Tp. 19, R. 26, W. 6 M.
2017	Hat creek	Tp. 19, R. 26, W. 6 M.
2018	Hefferley creek	Tp. 22, R. 17, W. 6 M.
2019	Hefferley creek	Tp. 22, R. 16, W. 6 M.
2020	Ingram creek	Tp. 17, R. 13, W. 6 M.
2021	Jacko creek	Tp. 19, R. 18, W. 6 M.
2022	Jamieson creek	Tp. 22, R. 17, W. 6 M.
2023	Louis creek	Tp. 23, R. 15, W. 6 M.
2024	Monté creek	Tp. 19, R. 15, W. 6 M.
2025	Monté creek	Tp. 18, R. 14, W. 6 M.
2026	Monté creek	Tp. 18, R. 14, W. 6 M.
2027	Nahatlatch river, lower station	Tp. 2, R. 26, W. 6 M.
2028	Nahatlatch river, upper station	Tp. 12, R. 27, W. 6 M.
2029	Nicola river, Merritt	Water District No. 3.
2030	Nicola river	Tp. 17, R. 25, W. 6 M.
2031	Niskonlith creek	Tp. 21, R. 13, W. 6 M.
2032	Paul creek	Tp. 20, R. 15, W. 6 M.
2033	Paul creek	Tp. 20, R. 15, W. 6 M.
2034	Shuswap river	Tp. 18, R. 9, W. 6 M.
2035	Shuswap river, Lumby	Water District No. 4.
2036	Scottie creek	Tp. 23, R. 25, W. 6 M.
2037	Spius creek	Tp. 13, R. 23, W. 6 M.
2038	Stein creek	Tp. 15, R. 27, W. 6 M.
2039	Thompson river	Tp. 17, R. 25, W. 6 M.
2040	Thompson river	Tp. 17, R. 20, W. 6 M.
2041	North Thompson river	Tp. 21, R. 17, W. 6 M.
2042	South Thompson river	Tp. 21, R. 13, W. 6 M.
2043	Tranquille river	Tp. 23, R. 19, W. 6 M.

NELSON DIVISION.—List of Regular Metering Stations.

No. of Station.	River.	Location.
3000..	Akolkole river..	Tp. 21, R. 1, W. 6 M.
3001..	Beaver river.....	Tp. 29, R. 25, W. 5 M.
3002..	Blaeberry river...	Tp. 28, R. 22, W. 5 M.
3003..	Bugaboo creek, Spillimacheen..	Water District No. 8.
3004..	Columbia river, near Golden...	Tp. 27, R. 22, W. 5 M.
3005..	Columbia river, at Revelstoke.	Tp. 23, R. 2, W. 6 M.
3006...	Columbia river, at Castlegar..	Water District No. 6.
3007..	Columbia river, at Trail.....	Water District No. 6.
3008..	Horsethief creek, at Wilmer.....	Water District No. 8.
3009...	Illecillewaet river, at Revelstoke..	Tp. 23, R. 2, W. 6 M.
3010...	Illecillewaet river, at Glacier.....	Tp. 26, R. 26, W. 5, M.
3011...	Kicking Horse river, at Golden	Tp. 27, R. 22, W. 5 M.
3012...	Kicking Horse river, at Field.	Tp. 28, R. 18, W. 5 M.
3013...	Kicking Horse, No. 2 tunnel.	Tp. 28, R. 18, W. 5 M.
3014...	Kootenay river, at Glade.	Water District No. 6.
3015..	No. 2 creek, at Wilmer	Water District No. 8.
3016..	Ottertail river.....	Tp. 27, R. 19, W. 5 M.
3017...	Pend d'Oreille river, at Waneta.	Water District No. 6.
3018...	Slocan river at Slocan.....	Water District No. 6.
3019...	Spillimacheen river, at Spillimacheen..	Water District No. 8.
3020...	Toby creek, at Athalmere.....	Water District No. 8.

MISCELLANEOUS METERING STATIONS.

Miscellaneous meterings were taken on the following rivers and creeks:—

COAST DIVISION—MISCELLANEOUS METERING STATIONS.

Belknap, Bridge, Capilano, Cheakamus, Green, Hixon, Lillooet, Lynn, Seymour, Slollicum.

KAMLOOPS DIVISION.—MISCELLANEOUS METERING STATIONS.

Bear, Campbell, Cache, Cornwall, Cleme's, Dairy, Duffy, Eagle, Eight-mile, Fortunes, Fadear, Gordon, Highfalls, Mission, Murray, Maiden, Nelson, Oregon Jack, Power, Ross Ray, Scotch, Shuswap, Seymour, Three-mile, Tulameen, Twenty-mile, Twall, Venables.

NELSON DIVISION.—MISCELLANEOUS METERING STATIONS.

Incomappleux, Yoho.

Many of the metering stations were established too late in the fall to get a sufficient number of measurements to plot the hydrographs from which the daily flow data are computed. The available data on these rivers are recorded as miscellaneous measurements.

The stations on these rivers will be maintained during the coming year as regular metering stations.

OUTLINE OF WORK FOR NEXT YEAR.

Up to the present time the yearly appropriation has not been sufficient to maintain the engineers in the field during the winter months. A few miscellaneous winter measurements have been taken, but there are no complete yearly run-off records except on those rivers in the Coast division which do not freeze up. From the time the survey was organized, a particularly thorough study has been made of the irrigation streams in the dry belt, and for the last three years the data on these streams, during the irrigation period, are very complete.

In the Nelson division the climate is humid, and little water is used for irrigation, the more important uses of water being for power, lumbering, and municipal water supply. It is readily seen that only seven or eight months run-off records for each year greatly limit the value of these data. The situation as regards power and municipal water supply in the Kamloops division is much the same and, although the power possibilities may not be so great as in the Nelson division they are equally important. If the appropriation for the survey is sufficient, it is my intention to have the engineers who are making a study of power and municipal water supply, maintained in the field during the entire year.

To keep pace with the increasing demand for hydrographic data, it is essential that the staff be sufficiently increased to maintain nine hydrographic parties in the field. New lines of railroad are rapidly opening up new country which will, in the near future, demand the utilization of the water resources.

Transportation has been the big item in the maintenance of the parties in the field, and this, I think, should be minimized if the territory to be covered in the different divisions be divided as follows, and worked from the most central city or town.

COAST DIVISION.

(1) Vancouver to cover Railway Belt and south to the boundary.

(2) Victoria to cover Vancouver island and territory north along the coast of the province.

(3) Lillooet to cover the territory along the Pacific Great Eastern.

KAMLOOPS DIVISION.

(1) Kamloops to cover the local irrigation streams, the rivers along the Canadian Northern railway to Yellow Head pass and the rivers tributary to Shuswap lake.

(2) Ashcroft to cover the rivers in Ashcroft and Merritt vicinity.

(3) Penticton to cover Okanagan river and its tributaries.

NELSON DIVISION.

(1) Golden to cover Upper Columbia river and tributaries.

(2) Nelson to cover Lower Columbia river and Kettle river and their tributaries.

(3) Cranbrook to cover Kootenay river and tributaries.

DEFINITION OF TERMS.

The volume of water flowing in a stream-run-off or discharge is expressed in various terms, each of which has become associated with a certain class of work. Some of the terms generally used are: "Second-feet," "gallons per minute," "discharge in second-feet per square mile," "Run-off depth in inches on drainage area," and "total run-off in acre-feet."

"Second-feet" is an abbreviation for cubic feet per second, and is the unit for the rate of discharge of water flowing in a stream 1 foot wide, 1 foot deep, at the rate of 1 foot per second.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second for each square mile of drainage area.

"Run-off in inches" is the depth by which the drainage area would be covered if all the water flowing from it were uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually given in inches.

An "foot-acre" is equivalent to 43,560 cubic feet, that is, the quantity required to cover an acre to the depth of 1 foot, and is commonly used in connection with storage.

CONVENIENT EQUIVALENTS.

The following is a list of convenient equivalents for use in hydraulic computations:—

1 second-foot equals 6.24 British imperial gallons per second.
1 second-foot equals 7.48 United States gallons per second.
1 second-foot for one day covers 1 square mile 0.03719 inch deep.
1 second-foot for one day equals 1.983 acre-feet.
1 acre-foot equals 325,850 United States gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 acre equals 43,560 square feet.
1 cubic foot equals 6.24 gallons.
1 cubic foot of water weighs 6.24 pounds.
1 horse-power equals 550-foot pounds per second.
1 horse-power equals 1 second-foot falling 8.80 feet.
1 horse-power equals 746 watts.
1⅓ horse-power equals about 1 kilowatt.

To calculate water-power quickly $\frac{\text{sec.-feet x fall in feet}}{11}$ = net horse-power on water wheel realizing 80 per cent of theoretical power.

GENERAL METHODS OF STREAM MEASUREMENTS.

In measuring the flow of streams the basic assumption is that the discharge of the stream varies with the stage, or in other words that for a given stage there is a corresponding discharge. Where this relation holds, it is possible, by taking a series of measurements of the discharge and noting the corresponding stages, to plot a curve which will give the relation between stage and discharge. Having determined such a relation, it is only necessary to take daily records of the stage of the stream in order to compute the daily discharge.

The stage of the stream is measured by some form of stream gauge which gives the elevation of the surface of the water above a fixed datum. The types of gauges in use by this survey are the staff gauge, the chain gauge, and the recording gauge. The vertical staff gauge is used wherever possible. In some cases, however, where it is impossible to use a staff gauge, a chain gauge or a recording gauge is installed, depending on the different conditions encountered.

The standard method for the measurement of discharge is by the use of the current-meter. The instrument used is the small Price electric current-meter (No. 623, manufactured by W. & L. E. Gurley, Troy, N.Y.). In this method the area of the section is determined by taking soundings at measured intervals across the stream, the mean velocity is determined by a series of readings of the current-meter, and from these two sets of measurements the discharge is calculated.

Occasionally circumstances arise under which it is permissible to use other methods for measuring discharge. In very small irrigation ditches, where the cross-sectional area of the water would greatly disturb the natural flow, an approximate measurement can be made by means of surface-floats. The surface-float method is occasionally used for the measurement of flood discharges in very large streams where, owing to the high velocity, the ordinary equipment could not be used.

From investigations made by this survey on the larger streams in this province, the average velocity ranges from 0.85 to 0.90 of the surface velocity, so that the mean surface velocity in feet per second, multiplied by the cross-sectional area in square feet, multiplied by a constant K (the said constant ranging as stated above from 0.85 to 0.90) is equal to the discharge in second-feet.

The weir method might be used occasionally on very small irrigation streams, provided it is placed in such a position as not to affect the level of the water at the existing gauge. On the larger streams, the expense of constructing the weir for measurement purposes only, is too great, and there are very few dams in the province which could be so used. The use of weirs for obtaining the daily discharge of a stream is not recommended on account of the greater accuracy necessary in taking the readings, the errors introduced by material logging against the crest and the difficulties of getting a weir that will be accurate at all stages of the stream. Nevertheless where the person who is to take the daily readings thoroughly understands all the requirements necessary for accurate weir measurements, this method gives very good results.

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REPORT

OF

BRITISH COLUMBIA HYDROGRAPHIC SURVEY FOR 1913

CHAPTER 2

Coast Division

REPORT OF C. G. CLINE, Jr. Can. Soc. C.E., D.L.S.,
Divisional Engineer

CHAPTER II.

COAST DIVISION.

The division of the province for the work of the British Columbia Hydrographic Survey has been made with a view to facilitating the work as much as possible. Drainage areas have been kept intact as nearly as possible, the dividing lines following the watersheds. For this reason it is difficult to definitely describe the boundaries of the Coast division, but they may be readily seen by referring to the map accompanying this report.

The hydrographic work on the streams in the Railway Belt, which was commenced in 1911 and 1912, has been continued, and there are now two years' complete records for many of them. In addition to this work, regular stations have been established on a number of streams outside the Railway Belt, including those at North Vancouver and those between Squamish and Lillooet near the route of the Pacific Great Eastern railway. Most of these streams are listed under "Miscellaneous Measurements," having regular stations, and will appear as such in the 1914 report wherever sufficient meter measurements have been taken to relate the gauge readings to the discharge.

A considerable amount of work has already been done on Vancouver island by the engineers of the Water Rights Branch of the Provincial Government and the results of their work is contained in the 1913 report of that branch. It is expected that the stream measurement on the island in 1914 will be done by the British Columbia Hydrographic Survey while, in addition to this new work, it is expected that a number of new stations will be established in the Coast division, particularly in the vicinity of Lillooet. The measurements and records on the older stations and on the new ones already established will be continued, and their accuracy and reliability increased wherever possible.

Reclamation-Pitt Meadows Dyke South of Sturgeon Slough.

A general description of the main characteristics of this part of the province is here given, special attention being paid to all matters pertaining to the use and control of the streams. Following the general description is the information and data on the individual streams.

Reclamation-Pitt Meadows Dyke South of Sturgeon Slough.

CLIMATE.

The climate of Vancouver island and the coast generally, corresponds very closely with that of England; the summers are fine and warm, with bright sunshine, and severe frost scarcely ever occurs in winter. On the mainland, similar conditions prevail till the higher levels are reached, where the winters are colder. Summer frosts are rare except in the higher altitudes. The rainfall, generally speaking, is heavy, but the greater portion falls during the autumn and winter. Farther north, and in the higher altitudes, the winters are more severe and the annual precipitation lighter.

On the report on each stream in the Coast division will be found notes on the general climatic conditions, annual precipitation, etc. The records from the meteorological stations in the Coast division are used for this purpose whenever available.

AGRICULTURE.

The area of valuable agricultural land in the Coast district is very difficult to estimate on account of the very rugged and mountainous nature of the country. There is, however, a far larger area than one is led to believe on a superficial view of the country, as many of the valleys and benches which appear to be narrow, stony, and worthless, often prove to be of great agricultural value. Only a small portion of the available lands have as yet been taken up owing to the heavy cost of clearing and the lack of transportation facilities in many parts. The latter, however, is being gradually overcome with the construction of new railways.

The great proportion of the agricultural areas lies in the valleys and lower benches, but the higher altitudes are often found to contain good grazing areas. All the ordinary fruit and field crops do well in the lower altitudes, while the higher areas are used for raising hay, and grazing.

In this district, diversified farming is gradually superseding special farming, as it is found to be more profitable than any special branch of the industry, except in districts immediately adjoining the larger centres of population.

The rapid growth of the Coast cities has led to the lands in their vicinity to be used almost exclusively for supplying the vegetables, fruits, poultry, and dairy products where an ever-increasing market is found, making this branch of farming a very profitable industry.

Districts, remote from railways and other means of cheap transportation, have been confined more particularly to raising cattle and horses. This is particularly true of Pemberton Meadows and the Lillooet country. In order to winter the stock it is necessary to grow hay and other forage crops, while a certain amount of fruit and vegetables are grown for local use. With the completion of the Pacific Great Eastern railway, this district will probably develop into a mixed-farming country.

IRRIGATION.

Irrigation is necessary in only a small portion of the Coast division, and the apportionment of water for such a purpose is not so great a problem as in some other parts of the province, although the proximity of a large irrigation country affords demonstration of the advantages of irrigation, and the mountainous nature of the country allows the method to be readily applied wherever it is desirable.

Reclamation-Pitt Meadows Pump House and Sluice Gates.

Along the coast and for many miles inland, the rainfall is so heavy that the farmer requires special means of drainage. However, much of this precipitation falls in the winter, and not during the growing season, hence there is much less moisture than the figures for the annual precipitation would seem to indicate. In the vicinity of Hope, where there is a mean annual rainfall of some 50 inches, irrigation is practised to a certain extent and promotes crops during a dry summer.

Some of the country in the vicinity of Lillooet is included in the Coast division though climatically it is part of the dry belt. Here irrigation is necessary to produce, crops, and the supply of water is rather limited. It is our intention to make a comprehensive study of the various sources that might be used for such a purpose, so that the Provincial Water Rights Branch may be supplied with all stream-flow data necessary for the proper administration of the water resources of that district. The results obtained will also be available for the water users themselves, and should be of considerable assistance in designing engineering works of any magnitude.

Reclamation-Pitt Meadows looking North of Sturgeon Slough showing flooded land to be reclaimed.

RECLAMATION.

Some of the most fertile agricultural land in the province is to be found in the rich alluvial meadows which comprise the delta of the Fraser river. These areas, being low, are subject to floods at certain seasons, and require dyking. There are other places also in the Coast division in which dyking or some form of reclamation is necessary. Wherever the work of this survey is connected with such projects, every assistance possible is rendered, and when there are streams to be diverted or otherwise controlled, the stream-flow data are particularly valuable.

LUMBERING.

It is estimated by the Provincial Forestry Branch that in the entire province there are over 100,000,000 acres of timber land, of which about 65,000,000 acres possess a topography and soil which will permit of the production of merchantable timber, which, when transportation means become available, can be profitably logged.

The present stand of merchantable timber in the province is estimated roughly at three hundred billion board feet. A conservative estimate places the amount of timber which can be cut annually without endangering the forests of the province at six and a half billion board feet; the amount of timber cut annually at present is only about one-fifth of this. Hence, as the demand for lumber increases the annual cut will be increased until the maximum economic amount is reached.

During 1912, about 75 per cent of the total amount of timber cut in the province came from the Coast district. The figures show a cut in this part of of the province of some seven hundred and eighty million board feet, composed mainly of fir and cedar, which grow to an immense size in the mild, moist climate of the coast.

Most of the lumbering is done during the summer months when the weather is mild and there is comparatively little rain, the logs being hauled through the woods by "donkey" engines and heavy steel cables to tide water or to the larger rivers, whence they can be floated to the mills. In some cases logging railroads are being built to reach the timber more distant from the waterways.

A number of the streams in the Coast division are used for running logs but only in the largest can logs be run at all seasons. Even during the heavier freshets, great difficulty is experienced on many of the streams, and in some cases the practice has been abandoned entirely. The great size of the logs makes it very difficult to run them, and logging railroads are gradually being adopted.

The large amount of territory which is covered by forest growth has a great effect in regulating the run-off of all the streams in the Coast division, the heavy foliage and dense underbrush holding the moisture. At the headwaters of most of the streams, very little timber has been removed, and this, together with the high altitude, tends to keep the winter snows from melting off entirely until well on in the summer. As there are heavy rains in the fall, the period of low water during the summer and fall is very short.

Reclamation—Pitt Meadows Dyke and Sluice Gates.

There are large tracts of country in the Coast division which are of greater value for timber than for any other purpose. Much of the land is rough, mountainous, and unsuitable for agriculture, while the timber produced is very valuable.

Pitt Lake from Mouth of Raven Creek.

FISHING.

Fishing is one of the largest industries in British Columbia, and is one that must be seriously considered in all power development schemes in order that this important industry shall not, in any way, be damaged.

Until recently commercial fishing was practically confined to the salmon which swarm in myriads up the rivers to the quieter waters in order to spawn. Now, however, the industry has largely developed and many other branches of fishing have been developed. In 1910 the catch of halibut in British Columbia was 21,500,000 pounds out of a total catch for the Dominion of 23,000,000 pounds. It will thus be seen that other branches of fishing are being largely developed.

The preservation of the salmon is almost a vital necessity to the province, and to that end a number of hatcheries have been established on the inland waters. No obstruction should be allowed to remain in any stream to hinder the fish from reaching the spawning grounds. For instance, if any considerable portion of the Fraser river or its tributaries was blocked for a single season so that the fish could not spawn, it would seriously diminish the run of salmon in the Fraser, four years later, and probably have considerable effect also on the run eight years and even twelve years after.

British Columbia is the anglers paradise. Thousands of tourists come here year after year to indulge in this sport on the inland lakes and streams where, with ideal surroundings, some of the finest fishing of the world is found. Every effort should be made to protect the fish and hence it is necessary to enforce certain restrictions on the use of the streams.

In every power development which includes any form of dam across the stream in the Coast division, proper provision should be made for the passage of salmon and other fish. This is particularly so in the case of the Fraser river.

It is neceesary to preserve the forest cover in order to maintain a regular stream flow. In such cases it would probably be best to reserve the timber, as was done by the Dominion Government in the case of the territory surrounding

Coquitlam lake, which provides the water supply for the city of New Westminster and also for the Vancouver Power Company's plant on Burrard inlet; the country surrounding this lake has been made into a reservation, and the land is not open for settlement.

SEWAGE DISPOSAL.

Special precautions are taken to keep the inland waters pure for the sake of the fish. In construction camps, as well as in more permanent settlements, it is not permissible to run untreated sewage into streams or lakes. Some fairly efficient form of treatment is necessary if it is to be disposed of in such a way. This is altogether apart from more stringent measures which may be necessary when a source of municipal water supply is likely to be effected.

INDUSTRIAL WASTE.

The disposal of sawdust or other industrial wastes in the streams is a great danger, as the fish are apt to mistake such things for food and be seriously injured thereby. Engineers and others establishing camps or factories at the coast would do well to see the regulations regarding the pollution of streams by all such waste materials.

TRANSPORTATION.

The history of British Columbia is composed to a great extent of the development of the transportation facilities of the province, and it will be necessary to continue this development for many years to come. In a mountainous country like this, it is no easy matter to build trails and roads, and the construction of railroads is much more difficult and expensive than in the other provinces, but still good progress has been made in the last few years, and conditions are gradually improving.

The Canadian Pacific railway has, since its construction, been the main line of traffic in British Columbia and for many years it was the only railroad in the province. Now, however, there are a number of other roads in operation or under construction in the Coast division, as well as in other parts. The Canadian Northern Pacific parallels the Canadian Pacific on the opposite side of the Fraser river. The British Columbia Electric Railway Company has interurban lines connecting Vancouver, Steveston, New Westminster, and Chilliwack. The Kettle Valley railway and the Vancouver Victoria and Eastern railway are being built up the Coquihalla river. The Pacific Great Eastern railway will connect North Vancouver, Squamish, Lillooet, and Fort George. A few miles of this road is being operated at present, and it is predicted that trains will be running from Squamish to Lillooet by the end of 1914. There are also a number of railways on Vancouver island.

The waterways of the Coast division are of considerable assistance in providing transportation. There are a number of steamships plying between various points along the coast. A couple of small steamers run up the lower Fraser river. Pitt lake and Harrison lake and the rivers which flow out of them can be navigated by motor launches, and provide access to streams which cannot be reached by any other means.

The mileage of roadways in this part of the province is quite small. There are roads in and around the more important centres, but as a rule they do not extend any great distance. There are roads along both sides of the Fraser river as far as Ruskin on the north side, and Hope on the south, and a number of cross-roads have been opened out from both of them. The construction of new roads is necessarily slow, but from year to year new ones are built opening up new districts.

Foreshore—Pitt River.

Foreshore—Pitt River.

Work has been progressing for some time on the new Pacific highway which it is proposed to extend eventually right across British Columbia to the prairies, and to make of it a great automobile highway for tourists traffic, as well as providing for local transportation. This road is to run from Vancouver,

through New Westminster and Chilliwack, and follow up Silver creek and across the divide to Princeton. When completed it will give access to the Skagit river.

In the Coast division it has been necessary for us to use practically every means of transportation at some time or other, at times being compelled to travel long distances on foot, sometimes carrying considerable packs. We use the best means of transportation available for our purposes, but circumstances sometimes make it necessary to fall back on some of the more primitive methods.

Transportation conditions in British Columbia have been outlined above mainly with a view to show their influence on the work of the British Columbia Hydrographic Survey. These same conditions, of course, have a great effect on the trade, commerce, and industry of the province and, with the improvement of the shipping facilities by rail and steamboat, the prosperity of the province is bound to increase. Every such development, therefore, is bound to add to the demand for electric power, both for transportation and for manufacturing, and hence increase the value of the water-power sites of the province.

MINING.

There is considerable mining activity in the territory included in the Coast division. The most important product is coal from the mines on Vancouver island. The value of the coal mined in 1912 was nearly five and a half million dollars. One of the most important producers was the Canadian Colliers, Ltd. This firm operates a number of mines in the vicinity of Union bay, and has several small railroad lines to convey the coal to tide-water. Power for these enterprises is now obtained from a hydro-electric plant on Puntledge river.

The Vancouver Portland Cement Co. at Todd inlet, on Vancouver island, which is operated by electric power transmitted from the British Columbia Electric Company's plant at Goldstream produces about $800,000 worth of cement annually.

The mining industry will probably utilize a larger amount of water-power in the future than it does at present. At one time considerable placer mining was done in the Coast division, and a large number of water records were taken out for this purpose. The placer deposits in this part of the province are not being worked to any extent now, though a few hydraulic mines are in operation in the Cariboo. As transportation and labour conditions improve, however, and better smelting facilities are provided, there will probably be an increase in the number of mines working on low grade ores and on the baser metals. In such mines it is necessary to handle a large tonnage cheaply in order to make the properties pay and a good supply of cheap power would be a considerable advantage. The Canadian Colliers serves as an example of the superiority of water-power over steam-power even when a cheap supply of fuel is available. It is to be expected that other companies operating mines of a permanent nature will follow this firm's example.

MANUFACTURING.

British Columbia is not as yet a great manufacturing province, though the value of the industries are gradually increasing, but the introduction of hydro-electric power and the improved transportation facilities are bound to promote industrial development in the province.

The electrical transmission of power has greatly benefitted certain industries which are carried on in the cities; and many other industries have been developed close to the sources of power so as to escape transmission charges. In the older parts of the country there has been a great increase in the use of water-power within the last decade or two, and great improvements have been made.

WATER-POWER.

In the Coast division there are a large number of good sites for developing water-power in various amounts. Several plants have already been constructed, and a number of other propositions are being investigated by various companies and individuals. The power possibilities, if any, of each stream which has been investigated by the engineers of this survey are described, and where plants have already been constructed or where it is proposed to construct them, descriptions are also given.

PLANTS ON STREAMS INVESTIGATED WITHIN THE RAILWAY BELT.

Coquitlam River.

The Vancouver Power Company generates its power mainly at its two plants on Buntzen lake. These plants are situated on the North Arm of Burrard inlet and use the water of the Coquitlam river under a head of 400 feet. There is a storage dam on lake Coquitlam, and the water is conveyed through a tunnel 12,775 feet long to lake Buntzen. This latter lake acts as an equalizing reservoir, and from it the water is led through penstocks to the power-house.

The power generated is used for lighting and industrial purposes in Vancouver, New Westminster, Steveston, Chilliwack, and the lower mainland generally, as well as for operating city and interurban car lines in the same district.

Stave River.

The Western Canada Power Company has a plant on the Stave river at Stave falls. A series of dams near the power-house raises the level of Stave lake, and provides good storage. Short steel penstocks carry the water from the dam to the power-house. The head varies from 100 to 120 feet according to the level of the lake.

Gilley Creek.

Gilley Bros., of New Westminster, operate a rock quarry on Pitt lake by means of water-power from Gilley creek. A wooden stave pipe is used to convey the water to two small Pelton wheels which drive the screening plant and air compressor mechanically. A third wheel is used to drive a small dynamo which supplies current for lighting at night. There is a storage dam on Munro lake to regulate the flow of the stream. The total available head is about 2,000 feet, but only 600 feet is being used at present.

The flow of this stream was given in the annual report for 1911 and 1912.

DEVELOPED POWER SITES ON STREAMS OUTSIDE RAILWAY BELT.

Jordan River.

The Vancouver Island Power Company has a plant on Jordan river and supplies power to the Victoria branch of the British Columbia Electric Railway Company.

Puntledge River.

The Canadian Collieries, Ltd., has a plant on Puntledge river near Union bay on the east coast of Vancouver island, supplying power to a number of mines and operating electric railways connecting the mines with tide-water. This plant is referred to under the heading "Mining" in the "General Report."

Powell River.

There is a water-power plant on the Powell river, which operates a large pulp-mill by direct mechanical drive.

UNDEVELOPED POWER SITES—IN TERRITORY ALREADY COVERED, NOT INCLUDING VANCOUVER ISLAND AND OTHER PARTS OF THE COAST DIVISION.

Bridge River.

A head of 2,000 feet could be developed at Bridge river by driving a tunnel through the ridge separating it from Seton lake. The water would be diverted into the tunnel from Bridge river and conveyed from the other portal by steel penstocks to the power-house situated on Seton lake.

A great amount of power could be developed here, but the cost of the tunnel would render a large initial development necessary. The Pacific Great Eastern railway, which is being constructed along the north side of Seton lake, would provide good transportation but extra precaution would have to be taken to prevent a washout by any leaks or breaks in the tunnel or penstocks. Special provision might have to be made for carrying the extra discharge from Seton lake.

Chehalis River.

The plan of development on this stream includes a storage and intake dam near the lower end of Chehalis lake, and a large concrete pipeline, some 10 miles in length, to an equalizing reservoir near the mouth of the river. The penstocks would lead from the reservoir to the power-house, and would give a head of about 400 feet. Chehalis lake would give splendid storage. It might be possible to divert the flow of the west fork (Statlu creek) into the lake or into the pipeline.

It is not possible to maintain a gauging station near the lake for lack of a gauge reader. The flow given at the station at the mouth must be greatly reduced to give the flow available.

Chilliwack River.

Chilliwack river is quite a large stream, having a fall of about 2,000 feet between Chilliwack lake and the Fraser river.

At one time it was proposed to carry water from Chilliwack lake to Jones lake, but this scheme was abandoned owing to the heavy expense which would be involved, and also as it was found that Chilliwack lake was not at a sufficiently high elevation above Jones lake.

Another proposal is to construct a tunnel from the Upper Chilliwack valley to the valley of the Fraser river. This plan is probably quite feasible, but sufficient surveys have not been made to develop all its features. On account of the great expense of the tunnel, it would be necessary to make a large initial development.

Coquihalla River.

About 6 miles from Hope, and just above the mouth of the Nicolum river, the Coquihalla flows through a narrow gorge from 30 to 70 feet wide. The precipitous rock walls rise to a height of 150 feet. By constructing a dam at this canyon, a head of 100 or 125 feet could be obtained. The power-house could be built opposite the mouth of the Nicolum river, and the water conveyed to it from the dam through a tunnel.

Below the mouth of the Nicolum river is another small canyon and falls (Natural Bridge), but it would be rather expensive to utilize this fall with the other.

The gauging station gives the flow of the whole river, including that of the Nicolum, but the waters of this stream could not be used in the upper development.

Green River.

At Nairn falls there is a good site for a development. An intake dam could be built on a rock foundation above the falls and connected by a short penstock with the power-house built below the falls. The Pacific Great Eastern railway is being built along the river bank within a few hundred feet of the falls, and would give good transportation.

The presence of the railway along the east shore of Green lake will seriously interfere with the use of the lake for storage, and there would be very little pondage at the falls, but it might be possible to store water on the tributaries, Soo river or Six-mile creek.

Jones Creek.

The Vancouver Power Company has been investigating Jones creek as a possible source of power. The plan is to drive a tunnel through the ridge between Jones lake and the Fraser valley. The tunnel would be 10,200 feet long. Steel penstocks, 6,000 feet in length, would lead from the portal to the power-house on the bank of the Fraser river.

A dam near the outlet of the lake would provide considerable storage. Boulder creek could easily be diverted into the lake. This plant would utilize the combined flow of Jones and Boulder creeks, and would be fairly well regulated by the storage in Jones lake, under a head of 1,800 feet.

Mesliloet (Indian) River and tributaries.

The Westminster Power Company proposes to develop power from the Mesliloet river and tributaries, and have already made extension surveys. Splendid storage facilities are available in Norton, Young, and Ann lakes; from the first named lake a head of 2,000 feet could be developed.

North Lillooet River.

A small amount of power could be developed at a falls on the North Lillooet river. The municipality of Maple Ridge, however, has applied for the right to use part of the water for domestic purposes.

Rainbow Creek.

A series of falls near the mouth of the creek give a head of 630 feet in about half a mile. A small diversion dam could be built at the head of the falls to turn the water into the pipeline. A power-house could be built on the flat at the mouth of the river, a few hundred feet from Pitt lake.

Raven (Rushton) Creek.

This is a small creek flowing into Pitt lake. Rushton lake is 700 feet above Pitt lake and only 4,000 feet distant. About 1,000 feet from Pitt lake there is a fall of 100 feet. Mr. E. J. Fader proposes to run a pipeline from the head of the falls to a power-house to be built near the mouth of the creek. The power is to be used for running a rock quarry and gravel screening plant, neither of which have been built as yet.

Silver Creek (near Hope).

It would be quite possible to develop power on Silver creek which flows into the Fraser river, near Hope, though as yet no definite details of any such scheme have been worked out. There is a fall of 1,100 feet from Silver lake to the Fraser, but it is pretty evenly distributed over a distance of 5 miles. A long flume line would be necessary to develop any considerable amount of power. Silver lake might be used for storage as long as it did not damage the Pacific highway which is being built up the creek valley and along the lake.

Silver Creek (tributary Pitt river).

This stream might be used for developing a small amount of power, but the municipality of Coquitlam is planning to obtain its water supply from it.

Slollicum Creek.

This small stream discharges into an arm of Harrison lake. It has a series of falls near the mouth, with a total drop of 2,000 feet in about half a mile.

South Lillooet River.

Various plans have been proposed at different times for developing power on this stream. They are outlined under the description of the stream in this report.

Probably the simplest method from a physical standpoint would be to drive a tunnel from Lillooet lake to Stave lake. This would enable the Western Canada Power Company to use the water in their present plant at Stave falls and also in the plant they propose to construct near the mouth of the river. Another plant could be constructed on Stave lake below the outlet of the tunnel to utilize the fall from Lillooet lake to Stave lake, some 100 feet. This plan would give a very efficient means of utilizing the whole fall between Lillooet lake and the Fraser river.

MUNICIPAL WATER SUPPLY.

A number of streams in the Coast division are used for supplying water for various cities and municipalities. Most of these streams are being studied by the British Columbia Hydrographic Survey, and data and information about them are included in this report. For the sake of reference a list is given here:—

Vancouver and many of the surrounding municipalities obtain their supply from Capilano and Seymour creeks, and the water is carried across Burrard inlet at the First and Second Narrows, respectively, through submerged pipes.

North Vancouver is supplied from Lynn creek.

New Westminster has a pipeline from lake Coquitlam. The Vancouver Power Company, during the construction of the dam at the outlet of the lake, built a splendid intake tower and tunnel for the city.

The municipality of Coquitlam is preparing to install a system to draw water from Silver creek which flows into Pitt river from the north near Pitt lake.

The municipality of Maple Ridge has applied for water rights and a reservation of the watershed on the North Lillooet river.

In addition to the places mentioned above, Victoria and a number of other places on Vancouver island have installed water supply systems. It is our intention to continue this work of investigation of water supplies during 1914, with the extension of the work of the survey to include the island.

Where a stream or lake is used to provide a municipal water supply it is often advisable to reserve the entire water basin from settlement, as was done at Coquitlam lake for the New Westminster water supply. In this country

the upper drainage basins are at such high altitudes, and the land is of such mountainous and rocky nature, a reservation does not as a rule interfere with agricultural development, but keeps the water pure and uncontaminated and preserves the natural regimen of the stream.

CONCLUSION.

The foregoing outline of conditions in the Coast division should serve to show how intimately the streams are connected with the life of the province. The prosperity of the country is dependent to a great extent on the flow of the streams, and for many purposes it is necessary that the amount of this flow should be known quite accurately. The flow of each stream varies from day to day, so that continuous records are generally required.

Records of the flow of the more important streams in the Coast division are submitted herewith. It has been the aim to make these results as complete and accurate as possible under the circumstances. In locating the gauging stations, the purpose for which the returns would be used in each case has been kept steadily in mind. It is hoped, therefore, that the results obtained will not be of merely academic interest, but will be of great practical importanc in the development of this part of the province. The inquiries which are beginning to come to the office would indicate that such is the case.

REPORT

OF

BRITISH COLUMBIA HYDROGRAPHIC SURVEY FOR 1913

CHAPTER 3

Kamloops Division

REPORT OF E. M. DANN, D.L.S.
Divisional Engineer

CHAPTER III.

KAMLOOPS DIVISION.

The Kamloops Division is comprised of:—

(1) The Thompson river and all its tributaries.

(2) The Okanagan river and all its tributaries which lie north of the international boundary.

(3) The Fraser river at Lytton, and tributaries of the Fraser between and including Stein creek and the Nahatlatch river.

(4.) That portion of the Skagit river and its tributaries lying within the province of British Columbia.

AREA OF THE KAMLOOPS DIVISION.

The area of the Thompson river catchment basin is some 22,000 square miles.

The area of the Okanagan river catchment basin lying north of the forty-ninth parallel of latitude is about 6,000 square miles.

The area of that portion of the Fraser river drainage which lies within the Kamloops division is about 1,000 square miles.

The area of that portion of the Skagit river which lies north of the forty-ninth parallel is about 400 square miles.

It will readily be seen that this division which comprises roughly an area of 29,000 square miles can be most advantageously directed from Kamloops, where the divisional office is at present located. The division includes the provincial water districts Nos. 2, 3 and 4.

CLIMATE.

The Kamloops division has been outlined arbitrarily by drainage areas. It might almost as logically have been bounded by a 30-inch precipitation contour. With the exception of the upper reaches of the North Thompson, at no point within the Kamloops division does the mean precipitation exceed this amount, and the settled districts lying outside its boundaries where the precipitation is less may readily be enumerated. Speaking in general terms, the Kamloops division covers that portion of British Columbia popularly known as the "dry belt," in which irrigation is practised.

Within this section of country, precipitation varies from a minimum of 5 inches per annum in the vicinity of Ashcroft to a probable maximum of 35 inches near Tête Jaune Cache.

The mean annual precipitation and maximum and minimum temperatures (including snowfall 10 inches—1 inch rain) of several important centres in the district is appended.

Station.	Mean annual precipitation.	Maximum temperature ever recorded. (degree F.).	Minimum temperature ever recorded. (degree F.).
	In.	°	°
Kamloops	10·30	102·4 (1906)	−26·9 (1893)
Nicola lake	11·19	92·5 (1896)	−36·0 (1907)
Okanagan	12·62	96·2 (1908)	−19·4 (1907)
Princeton	13·05	101·0 (1897) (1904)	−45·0 (1907)
Salmon Arm	18·27	101·0 (1906) (1908)	−20·0 (1907)

It may be added that the periods of severe cold are almost always of very short duration, while intense heat is usually felt only after a time of prolonged drought. Within the dry belt, the exceptionally fine weather of the spring and autumn, and the long duration of these seasons, is remarkable.

NATURAL RESOURCES.

MINING.

Mining, except in the older section of the division, is still in its infancy. The principal mine, the largest of its kind in British Columbia, is the Nickel Plate Mine operated by the Hedley Gold Mining Company, at Hedley, B.C.; in the past year it yielded 38,000 ounces of gold, from which $360,000 was paid in dividends. A large stamp mill, a concentrator, a tramway, and other various essentials of this large organization are operated at present by hydro-electric power from Twenty-mile creek. As no material facilities for storage have been obtained, it has been necessary to operate an auxiliary steam plant during the winter months. A dam across the Similkameen river at Hedley is now under construction, and a larger hydro-electric plant is proposed by which the output of the mine may be increased 50 per cent. A head of 67 feet is obtainable in 3 miles, water being conveyed from the headgate to the penstocks in open flumes. It is thought that 1,500 horse-power to 1,700 horse-power may be obtained. The need of records of the flow of the Similkameen river has been felt by the designing engineers.

The coal mines of the Nicola valley come next in importance. These put on the market a variety of bituminous coal known as " Nicola," a good steam fuel, formerly largely used by the Canadian Pacific Railway. The substitution of oil-burning locomotives on certain divisions of the railway has tended to decrease the market for products of the mines. During 1912 the total output of this section was some 230,000 tons.

In the vicinity of Princeton and Tulameen, in the Similkameen valley, coal mines are in operation of which output during 1911 was about 25,000 tons (largely lignite).

Near Kamloops the "Iron Mask Mine," a low-grade copper mine, is in operation, the ore being shipped to a United States smelter.

Several placer gold mines have recently been discovered on Louis and Boulder creeks, north of Kamloops. The production at present is very small, but it is possible that these placer deposits will prove a valuable source of gold, and increase substantially the annual output of the precious metal in British Columbia.

Platinum has been procured in very limited quantities from gold-bearing gravels of the Tulameen river.

Cinnabar (mercury ore) has been discovered in the Kamloops district near Savona.

Gypsum exists in some quantity in the vicinity of Grand Prairie, near Kamloops, and an impure form of this mineral, known as "gypsite," is found near Merritt.

LUMBERING AND UTILIZATION OF WATER.

While the lumber industry is not as important in the Kamloops division as in the more humid sections to the east and west, still lumber companies are in many cases important water users. The Forest Mills, Ltd., have developed water-power of small capacity on Crazy creek at Taft, B.C. (see Water Power Developments).

The Adams River Lumber Company has a control dam on the Adams river, near Chase, B.C., and their rights on this stream may complicate hydro-electric development here. This company also uses water for sluicing from Bear creek, a tributary of Adams river.

The Arrow Lake Lumber Company diverts the water of Celeste creek, a feeder to Seymour Arm of Shuswap lakes, for sluicing purposes.

The Nicola Valley Pine Lumber Company has constructed a dam of rock-filled timber in Spius creek, which affords impound of about 25 acres.

AGRICULTURAL LAND AND IRRIGATION.

It has been estimated that there are at present some 100,000 acres of irrigable land in Kamloops, Similkameen, Okanagan, Nicola, and Shuswap districts.

While these figures are nothing more than an approximation, it is thought that they are conservative. There are a few sections where dry farming and the scientific rotation of crops is practised, and a few, where the rainfall is adequate, simple farming is carried on; but in the main, irrigation is essential for successful

Upper Columbia Valley Bottom Lands near Wilmer B.C.

farming, and year by year the old-fashioned methods are being superseded by the product of modern ideas. Where formerly the open gravel ditches or flumes of rough timber were seen paying their toll for inefficiency through leakage, seepage, and evaporation, one now sees the concrete lined and covered-in canals and the carefully constructed metal flumes. This applies at present, of course, only to the larger land companies whose initial capital has permitted the more expensive and efficient construction to be undertaken, but even the small farmer is paying more attention to this subject than heretofore.

Upper Columbia Valley Bottom Lands, near Wilmer, B.C.

Irrigation is at present carried on almost entirely by gravity methods, but the pumping of water from the larger rivers to the bottom and bench lands will open up a large field for future development.

A scientific study of pumping, including efficiency of various types of pumps, prime movers, and fuels is very advisable at the present time, as it will be the means of preventing costly mistakes on the part of those ranchers progressive enough to adopt this method of reclaiming arid land. As this question might well be considered in the jurisdiction of the British Columbia Hydrographic Survey, it is recommended that steps be taken in this connection during the coming season.

Fruit growing is the predominant pursuit in the Okanagan and portions of the Similkameen valleys, while mixed farming is carried on in the Kamloops, Nicola, and Shuswap sections. Stock raising is gone in for to a great extent, particularly in the vicinity of Kamloops, Ashcroft, and Merritt, where the ranges are eminently suited to this industry. Alfalfa is grown extensively in these sections for winter feeding.

The names of some of the larger irrigation companies in the Kamloops division which have constructed extensive irrigation works are appended: White River Valley Power Co. (Vernon), British Columbia Fruitlands (Kamloops), British Columbia Horticultural Estates (Walhachin), Barnes Estates (Walhachin), Summerland Development Co. (Summerland), Southern Okanagan Land Co. (Penticton), Belgo Canadian Land Co. (Kelowna), South Okanagan Land and Orchard Co. (Kelowna), Kelowna Irrigation Co. (Kelowna).

MUNICIPAL WATER SUPPLY.

The question of municipal water supply, which is a momentous problem in the more thickly populated districts of the world, while not yet so urgent or important in British Columbia owing to the physical features of this province, still it is a matter which, for the sake of the future, must receive intelligent thought.

Kamloops, the largest town in the dry belt, gets its water supply from the South Thompson river; Vernon, Kelowna, Salmon Arm, and Penticton, from adjacent mountain streams; Ashcroft from the Bonaparte river.

Sewage disposal is a matter which is intimately related to the question of water supply, especially in towns situated on the larger rivers. It is now considered an axiom that no practical method of sewage purification will entirely eliminate disease-producing germs, although modern methods will materially reduce them. Any city which derives its water supply from a river or stream into which other cities or communities discharge their sewage, whether treated or raw, will generally find it necessary to purify the stream's water before it may be safely used for domestic purposes.

While a study of velocity and discharge is necessary on streams from which a water supply is derived, and which act as a medium for the disposal of sewage, it is on the smaller streams that hydrographic work is of most importance. Since conditions do not always permit of the impounding of surplus run-off in reservoirs, the minimum discharge of any stream which is a source of water supply is of particular interest. An average city or town consumes 100 gallons of water per day per capita. This is considered to be a liberal estimate and is arrived at by taking the mean of various quantities used in numbers of cities and towns throughout the States United and Canada, in which countries, by the way, the wanton waste of water is notorious. (Johnston--"Purification of Public Water Supplies".)

WATER-POWER DEVELOPMENTS.

CITY OF KAMLOOPS PLANT ON BARRIÈRE RIVER.

The principal hydro-electric development in the Kamloops division is the city of Kamloops municipal plant of the Barrière river, for which Messrs. Ducane and Dutcher, of Vancouver, are designing and constructing engineers. Since 1911, records of flow have been obtained showing a maximum of 3,300 second-feet, and a low-water flow of 150 second-feet.

The plant will operate under a head of 196 feet, water being carried by 17,800 feet of flume line to the penstocks. Good storage facilities are afforded, and no serious interference from frazil or anchor ice is anticipated.

The initial capacity of the plant will be 1600 to 2000 horse-power and provision is being made for its ultimate extension to 10,000 horse-power. The cost of this initial undertaking is estimated at $237,600. The ultimate development will probably increase the cost by $250,000 to $300,000. Power will be generated at 2200 volts 3 phase, 60 cycles, being stepped up to 44,000 volts for transmission. Step-down transformers, switchboard, etc., will be located at the auxiliary steam plant power-house at Kamloops.

Two 1200-horsepower Francis type turbines are to be used for the initial development, each designed for direct connection. The flume line is of timber construction but will probably be replaced by metal flume or concrete-lined canal for the ultimate development. The forebay and power-house are of concrete construction. 15-foot timber dam of rock-filled cribbing is designed for the flume's intake.

OTHER SMALL DEVELOPMENTS.

The town of Spence's Bridge receives light and power from Murray creek, where a small development of 100 horse-power has been made. A Pelton wheel operating under a 220-foot head is used, 16-inch rivetted steel pipe conveying water to the wheel, the upper 175 feet of pipe being laid in rock tunnel.

Forest Mills, Limited, of Taft, B.C., has a Pelton wheel development of 160 horse-power operating under a head of 175 feet. Power is used for the saw-mill and for lighting the town of Taft.

The development of the Hedley Gold Mining Company on Twenty-mile creek in the Similkameen valley, is a Pelton wheel development, the power being used for operating the company's forty-stamp mill and concentrator, as well as for electric tramway and cable cars.

A small hydro-electric plant on the Bonaparte river, from which power has been used for the town of Ashcroft, is at present out of commission owing to the failure of the dam during the freshet of 1913. It is understood that the dam may not be replaced, in which case the town will continue to derive its power from its auxiliary steam plant.

FUTURE DEVELOPMENTS.

The Coteau Power Co., controlled by Mackenzie and Mann interests, propose an extensive development at Coteau Falls on the Shuswap river near Lumby, B.C. Nine thousand horse-power will be the capacity of the plant which, if constructed, may be used for the electrification of the Okanagan branch of the C.N.R.

The Hedley Gold Mining Company propose a development of 1500 horse-power on the Similkameen river at Hedley (see "Mining"). Construction will probably be carried on during 1914.

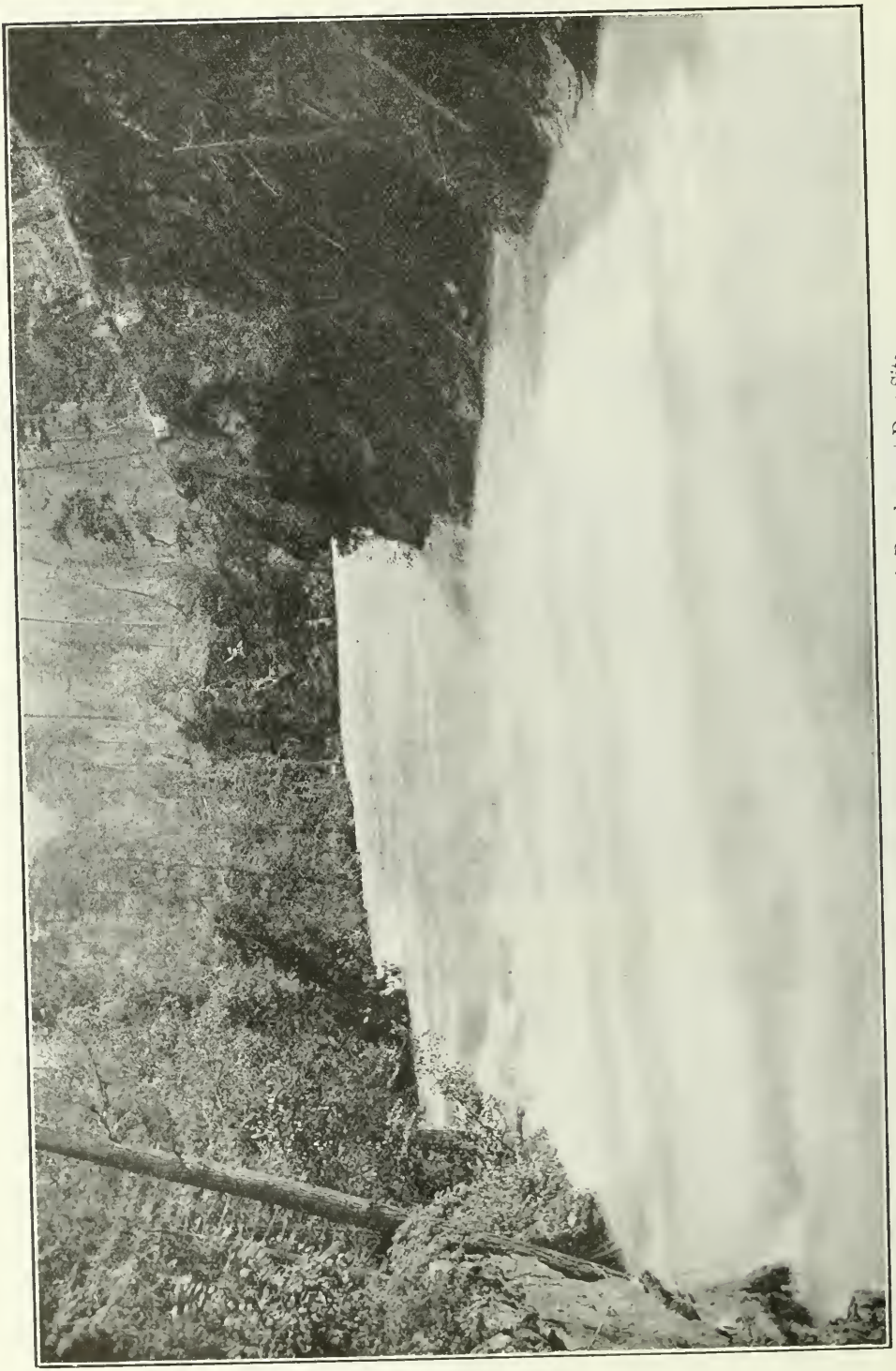
Myrtle River—Helmcken Falls clear drop of 450 feet.

The most important undeveloped sources of power in this district are: The Adams river near Chase, where a head of 200 feet in 6 miles, with a probable mean discharge of 1200 second-feet could be obtained. Adams lake forms an excellent storage basin, and no very important interests would be affected by damming its outlet.

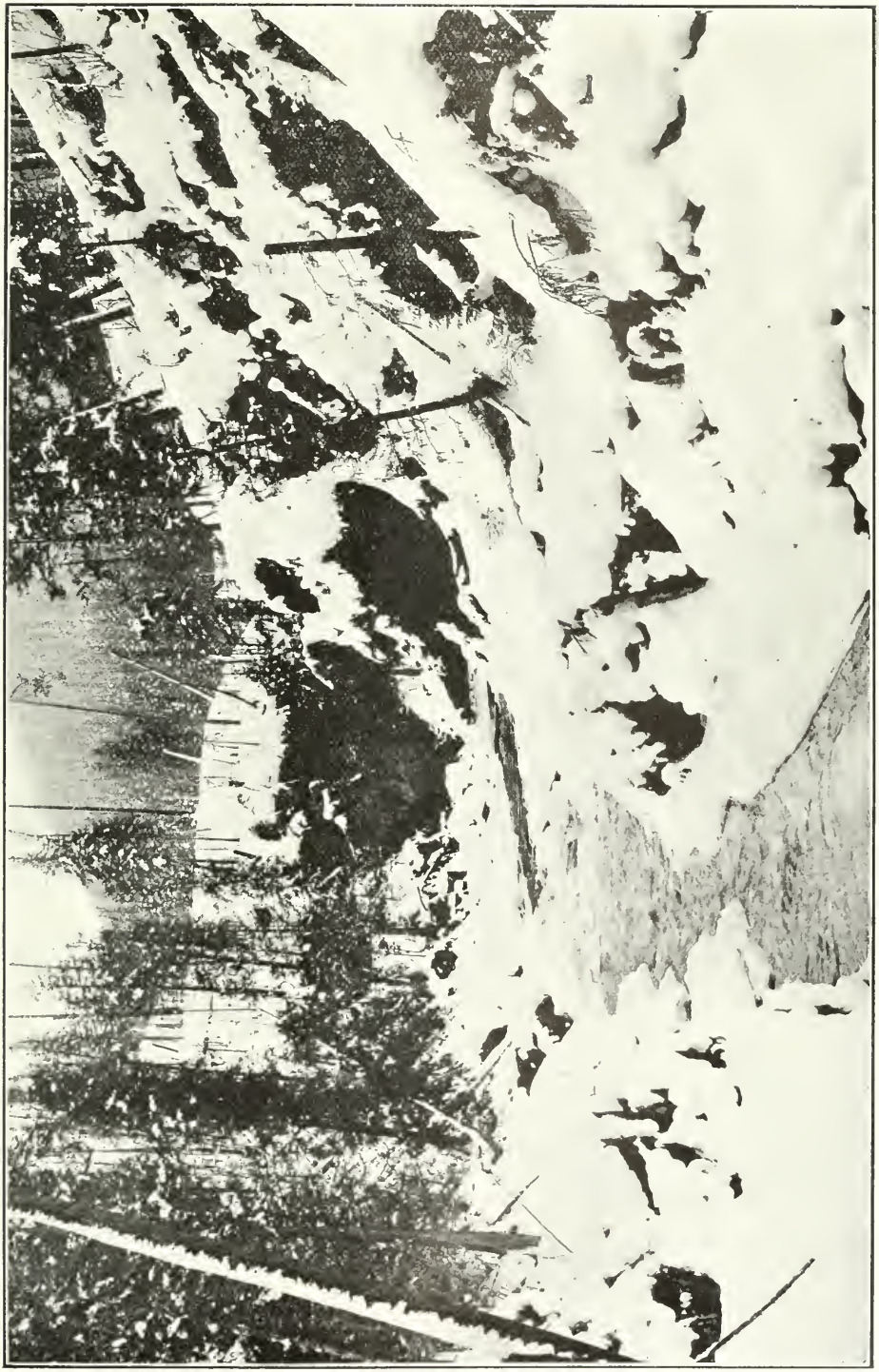
The Clearwater river has falls of considerable size, while on its main tributary, Myrtle creek, there is one sheer fall of 450 feet. Excellent storage is also said to be available. As yet no accurate data in regard to these powers are available, but it is our intention to begin the collection of information on these important streams during the coming season.

The Seymour river and Celeste creek in the Shuswap Lake drainage area, are important sources of water-power, while many smaller mountains stream will no doubt soon be utilized to supply the needs of progressive communities.

Barrière River—Intake Dam—City of Kamloops Development.



Shuswap River—Coteau Hydro-Electric Company's Development Dam Site.



Shuswap River—Cotcau Hydro-Electric Company's Development Dam Site.

REPORT

OF

BRITISH COLUMBIA HYDROGRAPHIC SURVEY FOR 1913

CHAPTER 4

Kootenay-boundary Division

REPORT OF C. E. RICHARDSON, A.M. Can. Soc. C.E.
Divisional Engineer

CHAPTER IV.

KOOTENAY BOUNDARY DIVISION.

GENERAL.

Kootenay Boundary division is that part of British Columbia known as East and West Kootenay districts and that part of Yale district which is drained by Kettle river (generally known as the Boundary district) or it might be described as comprising the whole drainage area of the Columbia river except the Okanagan river basin. The East and West Kootenays are divided by the Selkirk range, and these are encompassed on the north, south, east, and west by Columbia river and its tributary, the Kootenay.

The Columbia rises in Columbia and Windermere lakes, 90 miles south of the C.P.R. main line at Golden, and flows in a northwesterly direction for about 200 miles at the Big Bend, at which point it turns and runs southerly for about 250 miles, past Revelstoke, through Arrow Lakes, crossing the international boundary line at Waneta, B.C.

The Kootenay river rises in Beaverfoot range of the Rocky mountains about 20 miles south of the C.P.R. main line at Palliser, B.C., and flows for 175 miles in a southerly direction, passing within 1 mile of Columbia lake, and crossing the international boundary line at Gateway, B.C. It flows through Montana, into Idaho, re-entering British Columbia 60 miles west of Gateway and 20 miles south of Kootenay Landing, at which point it loses itself in Kootenay lake. From Kootenay lake, the river flows in a southwesterly direction, discharging into Columbia river at Castlegar, about 20 miles north of the international boundary line.

AREA AND DRAINAGES.

The total area of Kootenay Boundary division is approximately 32,000 square miles. Of this, some 15,000 square miles are drained by the Columbia above the mouth of Kootenay river. The Kootenay drains approximately 13,000 square miles in British Columbia. The boundary district comprises an area of about 3,000 square miles, drained by Kettle river. The remaining 1,000 square miles are drained by Pend d'Oreille river, of which Flathead creek is a tributary; Pend d'Oreille river discharges into the Columbia at Waneta, 200 yards north of the international boundary line.

CLIMATIC CONDITIONS.

A great variation in climatic conditions exists in the different sections of the Kootenay Boundary division. In part of southeast Kootenay and the Boundary the total precipitation is small, varying from 10 to 18 inches, and is similar to other semi-arid districts in British Columbia, where the summers are hot and dry, and the winters severe (−40°F.) with only a light snowfall.

In southwest Kootenay the summers are hot but the rainfall fairly heavy, average for May to September, 1908-12, being slightly over 10 inches at Nelson. During the winters the thermometer seldom goes below zero, and the larger rivers never freeze over. The precipitation is heavy, the snowfall in certain districts being about 6 feet. In the north half of both East and West Kootenays the summers are hot and the rainfall is fairly heavy (about the same as Nelson). The winters are severe (−50°F.) with heavy snowfall. At Glacier, on the C.P.R. main line, the snowfall varies from 40 to 50 feet each season.

RUN-OFF.

It would be a difficult matter to obtain a reliable factor to relate the run-off in surface waters with the precipitation, for it would necessitate a study for a series of consecutive years. All the larger and more important streams are glacial fed. Extreme high water in the summer is obtained in all probability through a combination of heavy snowfall during the preceding winter, with a series of hot days and nights in May and June and possibly July and August; warm rains also greatly increase the flow. At the same time it appears possible that very high water may be obtained by a series of hot days and nights when the precipitation has, apparently, not been very heavy during the preceding winter; this is particularly noticeable in the smaller drainages.

A more or less interesting comparison relating to the run-off on the east and west slopes of the Selkirks and the west slope of the Rockies in the vicinity of Revelstoke and Golden during the months May to September, 1913, is made herein. The streams considered are as follows:—

(1) West slope of the Selkirks—Illecillewaet, Akolkolex, and Incomappleux rivers.

(2) East slope of the Selkirks—Beaver and Spillimacheen rivers.

(3) East slope of the Rockies—Blaeberry and Kicking Horse rivers.

	Locality.	Drainage area in Square Miles.	Run-off Depth in inches.
1.	West slope of the Selkirks	1,045	62
2.	East " " "	980	39
3.	West " " Rockies	1,025	26

Probably 80 per cent of the run-off of the above-mentioned drainages is included in the months May to September. With the exception of Akolkolex river the streams are all about the same length—30 to 40 miles. The streams in localities (1) and (2) have their source in the same vicinity, i.e., Glacier National park. The streams on the west slopes of the Selkirks and Rockies (1) and (3) all flow in a southwesterly direction, while the Spillimacheen flows southeast and the Beaver northeast. The drainage areas of each individual stream (taken from Railway Belt maps) are not, perhaps, very accurate, but by taking the streams in groups the error is diminished. The figures above should show, within 15 per cent, the relative run-off on the three slopes in the localities above mentioned.

The work in the southern part of the division has just been started, and only investigations on the most important streams have been carried on. Comparisons of the Columbia river above the mouth of the Kootenay river, and the Kootenay river at the mouth and Pend d'Oreille river are as follows:—

Stream.	Drainage Area. in square miles	Run-off depth in inches. June to December, 1913.
Columbia, above the mouth of the Kootenay	15,000	36·1
Kootenay at mouth	19,000	22·1
Pend d'Oreille at mouth	26,600	12·5

The drainage of the Columbia river above the mouth of the Kootenay includes all the northern part of East and West Kootenays. The drainage of

Kootenay river includes the southern part of East and West Kootenays and a portion of northern Idaho and Montana. The drainage of the Pend d'Oreille includes areas in northeast Washington, southwest British Columbia, northern Idaho and northwestern Montana.

The above table shows in a marked manner the increase in run-off from the southern to the northern end of the division.

UTILIZATION OF WATER.

In dealing with the utilization of water the following divisions may be made:—

Mining.
Timber.
Irrigation.
Domestic and Municipal.
Hydro-electric Development.

MINING.

The following table shows the production of metals, coal, and coke in the Kootenay Boundary district of British Columbia for the year 1913:—

	Tons.	Value.
		$
Consolidated M. & S. Co	335,323	6,846,309
Granby M. S. & P. Co.	1,242,053	4,486,830
British Columbia Copper Co	622,442	1,887,394
Hedley Gold mines	70,727	792,330
Other stamp mills	53,488	548,199
Zinc shipments	9,017	194,452
Tonnage other ores milled, not included in above	240,300	
Total metalliferous	2,573,350	15,055,514
Less United States ores	73,250	829,938
Total British Columbia metalliferous	2,500,100	14,125,576
Less miscellaneous British Columbia ores	835	41,367
Kootenay and Boundary, metalliferous	2,499,265	14,084,209
Total coal sold	1,581,449	4,842,028
Total coal used for coke	492,902	1,713,178
Total value metalliferous coal and coke	4,573,616	20,639,415

Coke produced: 319,325 short tons at $5.36½ per ton.

In the above figures December is estimated in all cases.

In the operation of practically all mines the use of water is essential. The importance of water-power developments in connection with the operation of mines is shown in the table below. Between twenty and thirty small powers ranging from 50 to 750 horse-power are here shown, but it is regretted that this list is not complete; probably from six to ten more developments should be added. Aside from these small developments the majority of ore is mined by power procured from the West Kootenay Light and Power Company. After the ore is mined and shipped to the smelters, water and water-power again become an important factor; the three smelters in the Kootenay Boundary division using about 10,000 horse-power. The production in tons in the following list was

obtained through the courtesy of the Nelson *Daily News*. The accuracy of the horse-power developed is not guaranteed, there being a great variation in most cases, according to the season and the amount of power required.

Mine.	Locality.	1913. Production.	Horse-Power.	Remarks.
East Kootenay.				
Sullivan	Kimberly	35,925	350	Power from Mark creek, Silver-lead mine.
Monarch	Field	196	100	Power from Cathedral creek, Silver-lead mine.
Miscellaneous		1,782		
Total		37,683		
Boundary District.				
Granby Co	Phoenix	1,242,053		All mines are copper mines unless otherwise designated. Power is supplied to the Granby mines at Phoenix by the West Kootenay Power & Light Co.
Motherlode	Deadwood	303,996		Power is supplied by the West Kootenay Power & Light Co.
Rawhide	Phoenix	238,455		Power is supplied by the West Kootenay Power & Light Co.
Miscellaneous		14,472		
		1,798,976		
West Kootenay.				Except where otherwise mentioned, the ore production in West Kootenay is silver-lead.
Slocan District.[1]				
Standard	Silverton	14,967	650	Power from Four-mile creek.
Van Roi	"	627	540	Power from Granite creek.
Hewitt	"	231	325	Power from Four-mile creek.
Idaho-Alamo	Three Forks	276		Power from Carpenter creek, now in disuse.
Ruth	Sandon	471	150	Power from south fork of Carpenter creek.
Slocan Star	"	562	75	Power from Sandon and White creeks, tributaries to south fork of Carpenter creek.
Noble Five	"	53	300	Power from south fork of Carpenter creek.
Wonderful	"	50	140	Power from Tributary and Miller creeks, tributaries to south fork of Carpenter creek
Ivanhoe	"	37	275	Power from south fork of Carpenter creek.
Monitor-Ajax	Roseberry		150	Power from east fork of Wilson creek.
Payne	Sandon		300	Power from Payne and Reciprocity creeks.
Enterprise	Slocan		150	Power from Ten-mile creek.
Last Chance	Sandon		50	Power from Last Chance Slide creek.
Miscellaneous		6,105		
Total		23,379		

[1] Power used in Slocan District obtained through courtesy of W. J. E. Biker, District Engineer, Water Rights Branch, Nelson, B.C.

Mine.	Locality.	1913. Production.	Horse-Power.	Remarks.
West Kootenay—*Concluded.*				
(b) *Rossland District.*				
Centre Star	Rossland	156,441		Power is supplied to all mines at Rossland by the West Kootenay Power & Light Co.
Le Roi	"	63,039		Q.v. under hydro-electric developments.
Le Roi No. 2	"	20,515		
Le Roi No. 2 Concentrate	"	1,985		
Miscellaneous		694		
Total		242,694		
(c) *Nelson District.*				
Ymir-Wilcox	Ymir		40	Avalanche rapids.
Yankee Girl	"	2,034	150	This plant is now being installed. Water is taken from Wild Horse creek.
Arlington	Erie	400		
Motherlode	Sheep creek	24,728	600	Power from Sheep creek, Motherlode is a gold mine.
Nugget	"			Now amalgamated with Motherlode mine.
Molly Gibson	Nelson	950	200	Power from Kokanee creek.
Silver King	"	3,881		Power from West Kootenay Light & Power Co.
Queen Victoria	"	22,795		Power from the West Kootenay Light & Power Co. Copper mine.
Granite-Poorman	"	90		Power from the City of Nelson Light & Power Co.
Dundee	Ymir		200	Power from Beaver creek; 300-foot head.
Second Relief Mill	Salmo	4,870	250	Power from North Fork of Salmon river; 260-foot head.
Miscellaneous		32,059		
Total		86,396		
(d) *Ainsworth District.*				
Bluebell	Riondel	7,208	250	Power from Indian creek. Head about 750 feet.
Silver Hoard	Ainsworth	1,286	125	Development now being installed, water from Cedar creek.
No. 1	"	3,929		
Highland	"	1,129	500	Power from Cedar creek. Development now being installed.
Maestro	"	157		
Utica	Kaslo	628	200	Power from Twelve-mile creek, tributary to Kaslo river.
Whitewater	Whitewater	517	200	Power from Whitewater creek, tributary to Kaslo river.
Miscellaneous		48		
Total		14,902		

Smelters.	Locality.	1913. Tons Treated.	Horse-Power.	Remarks.
Consolidated	Trail	335,323	3,000	West Kootenay Light & Power Co.
Granby	Grand Forks	1,242,053	3,500	West Kootenay Light & Power Co.
			700	Development immediately above Smelter on north fork of Kettle river.
B. C. Copper	Greenwood	622,442	2,000	West Kootenay Light & Power Co.

TIMBER.

Among the great industries of Kootenay and Boundary districts is the lumber manufacturing business, the timber being logged from the great tracts of timber which cover the mountains of the vicinity. Many millions of dollars are invested in the timber limits and mills, and the amount of money expended annually in labour and supplies reaches a huge figure. In the mountain district of British Columbia there are in the neighbourhood of one hundred mills of various sizes, and the majority of these are in southeastern British Columbia.

The lumber industry in this district has been largely dependent upon the demand from the prairies, but this year some of the mills of the interior of the province claim that they will find a market in the United States, on account of the reduction in the duty which became effective with the passage of the new Tariff Bill. During 1913 market conditions in the Prairie Provinces were not particularly good, yet in spite of this fact it is estimated from the official figures of the amount shipped out that the value of the lumber exceeded $8,000,000. Low stocks in prairie lumber yards at the present time, together with last season's good crops, are pointed to as indicating an improved market during the coming year.

Lumber companies, which are scattered throughout the whole division, use the numerous streams for log-driving during the freshet in May, June, July, and August. In Boundary district on Kettle river the drive in 1913 amounted to 20,000,000 feet.

IRRIGATION LANDS.

The scarcity of agricultural lands and the richness of the soil necessitates the utilization of all available lands in an attempt to fulfil the demands of the local markets. With the exception of small plots here and there, the valleys of Columbia, Kootenay, and Kettle rivers afford the only location of agricultural lands. The two most important and largest farming localities are "Windermere-Cranbrook" and Grand Forks districts. In the first case, large benches along Columbia and Kootenay rivers have attracted many settlers, and large companies are now developing 10,000 to 20,000-acre tracts which would be of little value to the individual farmer on account of the prohibitive cost of installing an irrigation system. Grand Forks district is well known for its orchards, and the land generally brings a high price per acre. In the vicinity of Nelson and along Lower Arrow lake, large tracts of land have recently been cleared, and appearances tend to show that both fruit growing and mixed farming may be successfully carried on in these localities.

Irrigation is required in both Grand Forks and Windermere-Cranbrook districts. In the latter district the gravity system only is in use. The Columbia Valley Orchards are installing an extensive irrigation system, including about

20 miles of flume, and are obtaining water from the Vermilion river and Sinclair creek. The Columbia Valley Irrigated Fruit Lands Company at Invermere are also installing a large system by which they obtain water from Dutch, Toby, and Horsethief creeks. These two companies expect to irrigate about 100,000 acres of land. In Grand Forks district, pumping from Kettle river is used extensively. Power is supplied chiefly by the West Kootenay Light & Power Company. Very little irrigation is required in any other part of this division.

DOMESTIC AND MUNICIPAL.

The numerous small streams; particularly in East and West Kootenays, make it a simple matter for the settler to have his own pipeline and water supply. In the same way only a few villages should have difficulty in obtaining a suitable supply. It is hoped that this survey will be able to publish information which will assist in the installation of adequate water systems where such have not already been installed.

The following towns are lighted by hydro-electric developments: Revelstoke, Glacier, Nelson, Trail, Rossland, Grand Forks, Phoenix, Greenwood, Eholt, New Denver, Silverton, and Kaslo.

HYDRO-ELECTRIC DEVELOPMENTS.

The "Utilization of Water" has already been discussed under the four headings referring to "Mining," "Timber," "Irrigation," and "Municipal and Domestic," and in three of these headings hydro-electric developments have been mentioned. Practically every water plant for mining purposes is used to some degree as a hydro-electric development. Pumping by hydro-electric power for irrigation purposes is used in Grand Forks district, and some ten towns in this division are lighted by hydro-electric developments.

By far the most important development is that of the West Kootenay Light and Power Company, situated at Upper Bonnington falls on Kootenay river, 11 miles from Nelson. This plant is operating under a 64-foot head. Two 8,000-horse-power units are in operation, and a third unit of 10,000 horse-power is now being installed. The capacity of the plant is 36,000 horse-power and it was designed to use 3-runner turbines. Power is supplied to mines in Nelson, Rossland, and Boundary districts, to the smelters at Trail, Grand Forks and Greenwood, to light the towns of Rossland, Trail, Eholt, Grand Forks, and Phoenix, and for pumping for irrigation purposes in Grand Forks district.

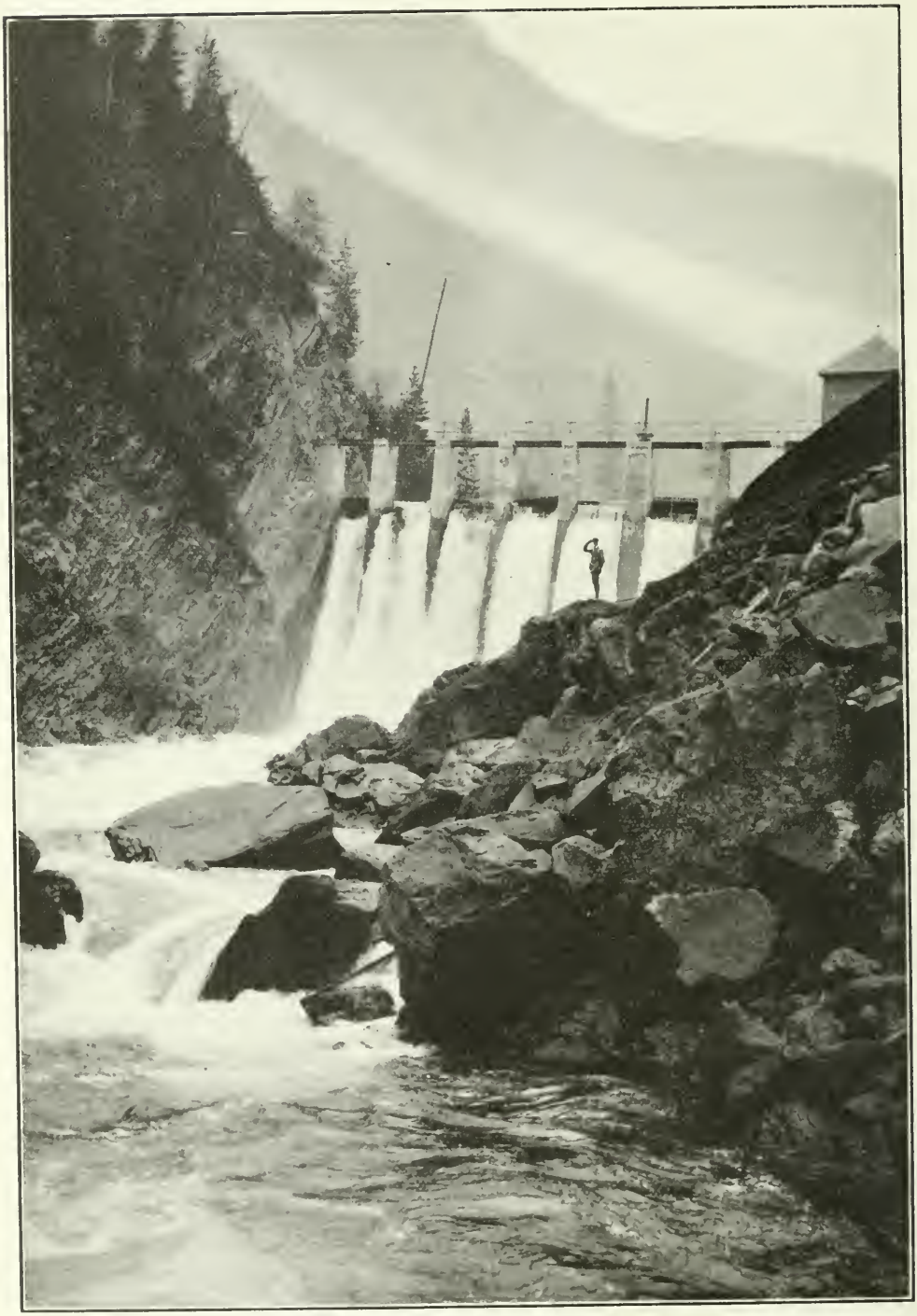
The West Kootenay Power and Light Company has two auxiliary plants, one at Lower Bonnington falls on Kootenay river, 12 miles from Nelson, and one on Kettle river at Cascade.

The plant at Lower Bonnington falls has a capacity of 4,000 horse-power, and operates under a head of about 40 feet.

At Cascade the plant is operated under a head of 155 feet, and the development exceeds 5,000 horse-power.

The City of Nelson Light and Power plant is situated at Upper Bonnington falls on the opposite shore to the West Kootenay Light and Power Company's plant. It is operated under a 60-foot head, and at present generates 1,250 k.w., the power is used to light the city of Nelson, to operate the city street railway, for manufacturing purposes in Nelson, and to operate one or two mines in the vicinty of Nelson.

On the north fork of Kettle river the Granby Mining, Smelting and Power Company have a small development. This plant is operated under a head of 30 feet, and supplies light and a small portion of the power used in the smelter; 700 horse-power is generated.



Illecillewaet River—Revelstoke Light and Power Company's Dam.

Greenwood City Power and Light plant is located at Boundary falls on Boundary creek. The plant is operated under a head of 130 feet, and supplies light to the city of Greenwood. Capacity 250 horse-power.

The City of Revelstoke Power and Light plant is located on Illecillewaet river about 2 miles from Revelstoke. A concrete dam has been built, and water is carried to the power-house, some 200 yards below, through a 6-foot stave pipe. The present plant is in duplicate on a 450 k.w. capacity basis.

The C.P.R. have a small installation on the Illecillewaet near Glacier the power generated being used for lighting their hotel at that point from May to October. The plant is operated under a head of 60 feet and about 100 horse-power. (12-hour power) is obtained. A concrete dam 15 feet high and 100 feet long affords a small storage, and to increase the flow in the early morning water is diverted from Asulkan brook.

New Denver, Silverton, and Kaslo have small developments for lighting purposes on Carpenter creek, Four-mile creek, and Kaslo river, respectively.

As the country progresses the demand for power increases, and it is expected that during the coming year several more plants of from 5,000 to 10,000 horse-power will be installed in this division.

HYDROGRAPHIC DATA.

GENERAL CHARACTERISTICS, 1913.

Throughout Kootenay-Boundary division in 1913 very high water existed. The snowfall during the winter 1912-13 was heavy, and for the first two weeks in June the days and nights were hot throughout practically the entire division. Columbia river below Arrow lakes became abnormally high and great damage was threatened; however, on the 15th of June cool weather set in throughout the Kootenay drainage area and continued for a sufficient length of time to check extreme high water. Nevertheless, two washouts occurred on the Great Northern between Waneta and Marcus along the Columbia. The Kootenay at Nelson registered about 8 feet higher than in 1912, and the water was up to the base of the C.P.R. rail at a point between Nelson and Granite. The streams in the northern half of East and West Kootenays aggregated a flow 20 per cent greater than the 1912 discharges.

RÉSUMÉ OF PROPOSED WORK FOR 1914.

Up to the present there has not been sufficient money available to investigate ice conditions, for which reason very little information is available as to minimum flow and winter discharges on the streams in East Kootenay, the northern part of West Kootenay, and the Boundary. It is proposed during the winter of 1914-15 to thoroughly investigate the behaviour of those streams on which there are power possibilities. Among those streams will be: Columbia at Revelstoke, Donald and Golden, Kicking Horse, Blaeberry, Toby, Horsethief, No. 2 Bugaboo, Spillimacheen, Beaver, Illecillewaet, Jordon, Akolkolex, Incomappleux, Kettle, Elk, Bull, and St. Marys. It is hoped that by May, 1914, to have stations established and to have systematic gaugings on sixty of the most important streams in Kootenay-Boundary division.

REPORT

OF

BRITISH COLUMBIA HYDROGRAPHIC SURVEY FOR 1913

CHAPTER 5

Coast Division—Hydrographic Data

CHAPTER V.

COAST DIVISION—HYDROGRAPHIC DATA.

REGULAR METERING STATION.

BELKNAP CREEK AT BELKNAP LAKE.

Location—Section 36, township 6, range 7, west of the 7th meridian.

Records Available—Continuous records since October 21, 1912.

Winter Conditions—Very heavy snowfall but practically no ice on the stream. Open water conditions all year.

Gauges—Staff gauge near outlet of lake—readings irregular, one or two per week.

Channel—Bed of stream strewn with rocks and boulders, giving uneven bottom but good control.

Discharge Measurements—One measurement in 1912 and six in 1913, well distributed— measurements made from cable carrier.

Accuracy—Good meter measurements, but gauge readings not regular, one or two per week.

BELKNAP CREEK.

Belknap creek rises at the foot of mount Ida, at an elevation of some 3000 feet, and discharges into Hixon creek below Belknap lake at an elevation of about 1500 feet. It is part of Burrard Inlet drainage. It would be very difficult to attempt to estimate the drainage area of the stream from the data at present available.

The precipitation in the Belknap creek watershed is probably between 120 and 150 inches per annum. There is very heavy snowfall in the winter, but the weather is not cold, and very little ice forms on the streams.

There are two important lakes on the creek; Ann lake, at an elevation of 2200 feet, has an area of 83 acres; Belknap lake, at an elevation of 1800 feet, has an area of 15 acres.

The Westminster Power Company proposes to include Belknap creek in the high head development. The latest proposal is to divert water from some point between Ann and Belknap lakes, and carry it by means of a short flume and pipeline into Norton lake, which is to be used as the main equalizing reservoir.

There are two gauging stations on Belknap creek. Up to the present the station at the lower end of Belknap lake is the one which has been most used. In 1913, however, a second station was established below Ann lake near the proposed site for the diversion to Norton lake. Meter measurements have been taken at this station, but no regular gauge readings.

Discharge Measurements of Belknap Creek at Belknap Lake, 1912-13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section	Mean Velocity.	Gauge Height.	Discharge
			Feet	Sq. ft.	Ft per sec.	Feet.	Sec-ft
Oct. 21, 1912.	C. G. Cline	1,646	33·0	50·8	0·66	1·60	33·7
June 4, 1913.	H. C. Hughes	1,673	35·0	101·3	2·66	3·20	257·0
" 11, 1913.	do	1,673	34·0	85·4	1·82	2·70	148·0
" 25, 1913.	do	1,673	33·5	87·6	1·76	2·65	147·9
July 22, 1913.	do	1,673	36·0	106·3	1·98	2·92	202·0
" 31, 1913	do	1,673	35·0	73·7	1·02	2·02	75·0
Sept. 22 1913.	F. MacLachlan	1,673	35·0	50·3	0·85	1·55	40·9

Monthly Discharge of Belknap Creek at Belknap Lake for 1913.

Month.	Discharge in Second-Feet.			Run-off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
January	8	8	8	491
February	33	8	14	777
March	11	9	11	676
April	65	9	38	2,260
May	202	25	82	5,040
June	255	155	174	10,400
July	192	93	137	8,420
August	87	33	54	3,320
September	93	25	54	3,210
October	409	15	81	4,980
November	61	25	40	2,380
December	41	21	33	2,030
The year	409	8	60·5	43,984

Note.—Accuracy "B" and "C".

Monthly Discharge of Belknap Creek below Belknap Lake for 1912.

Month.	Di-charge in Second-Feet.			Run-off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
November	65	15	48	2,860
December	27	8	14	860

Note.—Accuracy "B" and "C".

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Daily Gauge Heights and Discharges, Belknap Creek below Belknap for 1912.

Day.	October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1				51		13
2				52		12
3				53		11
4				54		10
5				55		9
6				56	0·7	8
7				57		10
8				58		12
9				59		14
10				60		16
11				61		18
12				62		20
13				63		22
14				64		24
15				65		26
16			1·9	65	1·4	27
17				61		24
18				57		21
19				53		18
20				49		15
21	1·6	41		45		12
22		41		41		10
23		42		37	0·7	8
24		43		33		8
25		44		29		8
26		45		25		8
27		46		23		8
28		47		20		8
29		48	1·2	17		8
30		49		15		8
31		50				8

Daily Gauge Heights and Discharges of Belknap Creek near Belknap Lake for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	0·7	8	0·7	8	.....	11	.....	11	.....	35	.....	215
2	.....	8	.....	8	.....	11	.....	11	.....	30	.....	228
3	.....	8	.....	8	.....	11	.....	10	1·35	25	.....	241
4	.....	8	.....	8	.....	11	.....	10	.....	33	3·2	255
5	.....	8	.....	8	.....	11	.....	10	.....	40	.....	240
6	.....	8	.....	8	.....	11	.....	10	.....	48	.....	226
7	.....	8	.....	8	.....	11	.....	10	.....	55	3·0	212
8	.....	8	.....	8	1·0	11	.....	10	.....	63	.....	198
9	.....	8	.....	8	.....	11	.....	9	1·95	70	.....	184
10	0·7	8	.....	8	.....	11	.....	9	.....	69	.....	170
11	.....	8	0·7	8	.....	11	0·8	9	.....	69	2·7	156
12	.....	8	.....	10	.....	11	.....	21	.....	68	.....	156
13	.....	8	.....	12	1·0	11	.....	33	.....	67	.....	156
14	.....	8	.....	15	.....	11	.....	45	.....	66	2·7	156
15	0·7	8	.....	17	.....	11	1·8	57	.....	66	.....	156
16	.....	8	.....	19	.....	11	.....	58	1·9	65	.....	155
17	.....	8	.....	22	.....	11	.....	59	.....	65	.....	155
18	.....	8	.....	24	.....	9	.....	60	.....	64	.....	154
19	.....	8	.....	27	.....	9	.....	60	.....	63	.....	153
20	.....	8	.....	30	0·8	9	.....	61	.....	62	.....	152
21	.....	8	1·5	33	.....	9	.....	62	1·85	61	.....	152
22	0·7	8	.....	25	.....	9	.....	63	.....	75	.....	151
23	.....	8	.....	18	.....	11	.....	64	.....	80	.....	150
24	.....	8	1·0	11	.....	11	.....	65	.....	103	.....	149
25	.....	8	.....	11	1·0	11	1·9	65	.....	117	2·65	148
26	.....	8	.....	11	.....	11	.....	60	.....	131	.....	151
27	.....	8	.....	11	.....	11	.....	55	.....	145	.....	154
28	.....	8	.....	11	.....	11	.....	50	.....	159	2·7	156
29	.....	8	.....	.....	.....	11	.....	45	.....	173	.....	156
30	0·7	8	.....	.....	.....	11	.....	40	.....	187	.....	155
31	.....	8	.....	.....	.....	11	.....	.....	2·95	202	.....	.....

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Daily Gauge Heights and Discharges of Belknap Creek near Belknap Lake for 1913—*Con.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1		154		87		48		44		25		40
2		153		81		55		33		30		40
3		152		75		63	1·3	22		35		40
4		150		70		70		22		40	1·6	41
5		148	1·9	65		78		22		45		41
6		146		63		85		22		50		41
7		143		61	2·2	93		22		55		40
8	2·6	141		59		88		22	1·85	61		40
9		138	1·8	57		82	1·3	22		56		39
10		135		57		76		152		49		38
11		131		57	1·95	70		282		44		38
12	2·5	127		57		59	3·9	409		41		37
13		120		57		48	3·6	343	1·55	37		36
14		113		57	1·55	37		246		37		36
15		106		57		35		148		37		35
16		99	1·8	57		35	1·8	57		37		35
17	2·2	93		59		31		57		37		34
18		105		61		28		56		37		34
19	2·4	114		63		26		56		38	1·5	33
20		140	1·9	65	1·35	25		55		38		32
21		166		63		31		55		38		31
22	2·9	192	1·6	41	1·55	37		54		38		30
23		183		39		41		54		38		29
24		174		37		45	1·75	53		39		28
25		165		36		50		47		39		27
26	2·7	156		34		54		41		39		26
27		144	1·5	33		58		35		39		25
28		132		33		62		29		39		24
29		129		33	1·92	67		23		40		23
30		106	1·5	33		56	1·15	15		40	1·3	22
31	2·2	93		40				20				21

BOULDER CREEK.

Location.—Section 28, township 3, range 27, west of 6th meridian, near mouth of creek and near Jones lake.

Records Available.—January 1 to October 18, 1913.

Winter Conditions.—Stream frozen parts of January, February, and March.

Gauge.—A fine wire is stretched tightly across the stream, and the distance down to the surface of the water is measured with a graduated rod. This rod is graduated just like an ordinary staff gauge, so that the actual readings are reversed, i.e., for a higher stage there is a smaller gauge reading.

Channel.—Bed of stream covered with rocks, giving an uneven bottom but good control.

Discharge Measurements.—Four meter measurements during 1911, 1912, and 1913 show good agreement, and cover all but the highest stages.

Accuracy.—The roughness of the bed of the stream will tend to impair the accuracy.

Boulder creek flows into Jones creek just below Jones lake in section 33, township 3, range 27, west of the 6th meridian, at an altitude of something like 1,950 feet. It drains a small mountainous watershed with an altitude of from 3,000 to 8,000 feet.

The flow of Boulder creek could easily be included in the development of Jones creek for hydro-electric power. An outline of a proposed scheme of development is given under Jones creek.

The flow of this creek is being investigated in connection with Jones creek for the Vancouver Power Company, by Messrs. Anderson and Warden, Civil Engineers, Vancouver. The gauge readings supplied by their men are combined with meter measurements made by the engineers of this survey to give the flow of the stream as shown below.

DISCHARGE MEASUREMENTS of Boulder Creek Mouth (Jones lake), 1911, 1912, and 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1911.							
Nov. 3	K. H. Smith	1,057	28	24	0·5	10·8	12·6
1912.							
Sept. 18	C. G. Cline	1,046	30	24	0·5	10·75	13·4
1913.							
July 24	K. G. Chisholm	1,055	27	52	1·6	10·1	84·6
Sept. 11	K.G.C. & F.M.	1,055	32	34	1·0	10·4	34·6

NOTE.—This gauge records the distance down from a fixed wire. Hence the readings are less for a higher discharge.

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Monthly Discharge of Boulder Creek near Jones lake for 1913.

Month.	Discharge in Second-Feet.			Run-off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
April	130	12	42·2	2,510
May	200	22	118·0	7,260
June	250	113	169·3	10,100
July	220	43	117·2	7,200
August	50	15	28·3	1,740
September	200	15	42·3	2,520
October	340	16	66·5	4,090
November	200	25	58·4	3,475
December	50	15	24·6	1,510

Daily Gauge Heights and Discharges of Boulder Creek near Mouth for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	10·65	19	10·75	15	Frozen		10·80	13	10·55	25	9·30	240
2	10·65	19	10·75	15			10·85	12	10·55	25	9·25	250
3	Frozen		10·75	15	10·80	13	10·85	12	10·60	22	9·25	250
4			10·75	15	10·80	13	10·85	12	10·60	22	9·32	236
5			Frozen		10·70	16	10·85	12	10·60	22	9·80	140
6					10·70	16	10·85	12	10·50	28	9·80	140
7					10·65	19	10·85	12	10·15	75	9·55	190
8					10·60	22	10·85	12	9·75	150	9·70	160
9					10·60	22	10·85	12	9·60	180	9·89	140
10					10·60	22	10·75	15	9·70	160	9·80	140
11			Frozen		10·65	19	10·40	37	9·75	150	9·80	140
12			10·85	12	10·65	19	10·00	105	9·90	120	9·80	140
13			10·85	12	10·70	16	10·15	75	9·90	120	9·50	200
14			10·80	13	10·70	16	10·25	57	10·05	95	9·60	180
15			10·40	37	10·70	16	10·25	57	9·95	113	9·80	140
16			9·80	140	10·65	19	10·35	43	10·00	105	9·80	140
17	Frozen		9·85	130	10·50	28	10·35	43	10·10	85	9·95	113
18			10·30	50	10·60	22	10·20	65	10·15	75	9·99	120
19			10·50	28	Frozen		9·90	129	9·95	113	9·50	200
20			10·55	25			10·05	95	10·00	105	9·40	220
21			10·66	22			9·85	130	10·30	105	9·70	160
22			10·65	19			10·15	75	9·80	140	9·70	160
23			Frozen				10·25	57	9·50	200	9·70	160
24							10·30	50	9·50	200	9·70	160
25							10·40	37	9·50	205	9·70	160
26							10·25	58	9·50	200	9·70	160
27							10·35	43	9·50	200	9·70	160
28							10·45	33	9·65	170	9·70	160
29	10·70	16			Frozen		10·45	33	9·80	140	9·70	160
30	10·70	16			10·80	13	10·59	28	9·80	140	9·70	160
31	10·70	16			10·80	13			9·60	180		

DAILY GAUGE HEIGHTS AND DISCHARGES Boulder Creek near Mouth for 1913—*Con.*

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	9·75	150	10·35	43	10·75	15	10·65	19	10·40	37	10·30	50
2	9·90	120	10·35	43	10·75	15	10·70	16	10·50	28	10·40	37
3	10·00	105	10·35	43	10·65	19	10·70	16	10·55	25	10·45	33
4	10·00	105	10·40	37	9·65	170	10·70	16	10·80	28	10·45	33
5	9·80	140	10·45	32	9·50	200	10·70	16	10·45	33	10·45	33
6	9·60	180	10·45	28	10·00	105	10·70	16	10·20	65	10·50	28
7	9·50	200	10·50	28	10·30	50	10·65	19	10·45	33	10·40	37
8	9·80	140	10·30	50	10·45	32	10·60	22	10·35	44	10·50	28
9	9·90	120	10·45	32	10·35	43	10·50	28	10·10	85	10·50	28
10	9·40	220	10·50	28	10·35	43	10·55	25	10·20	65	10·50	28
11	9·85	130	10·55	25	10·40	37	8·80	340	10·35	44	10·50	28
12	9·60	180	10·55	25	10·45	32	9·50	200	10·45	33	10·50	28
13	9·70	160	10·60	22	10·50	28	9·40	220	10·50	28	10·55	25
14	9·90	120	10·50	28	10·55	25	10·00	105	10·55	25	10·55	25
15	10·00	105	10·50	28	10·60	22	10·15	75	10·55	25	10·50	28
16	10·05	95	10·60	22	10·60	22	10·30	50	9·50	200	10·55	25
17	10·05	95	10·35	43	10·65	19	10·35	43	10·05	95	10·55	25
18	10·00	105	10·30	50	10·30	50	10·35	43	10·25	57	10·60	22
19	9·80	140	10·40	37	10·50	28	10·20	65	10·30	50	10·65	19
20	9·80	140	10·50	28	10·60	22	10·20	65	10·35	44	10·65	19
21	9·85	130	10·60	22	10·65	19	10·25	57	10·40	37	10·65	19
22	9·90	120	10·60	22	10·20	65	10·30	50	10·40	37	10·65	19
23	9·95	113	10·60	22	10·40	37	9·85	130	10·50	28	10·65	19
24	10·10	85	10·65	19	10·55	25	9·70	160	9·50	200	10·65	19
25	10·10	85	10·65	19	10·60	22	10·15	75	9·95	112	10·70	16
26	10·20	65	10·65	19	10·65	19	10·30	50	10·15	75	10·75	15
27	10·25	58	10·70	16	10·65	19	10·35	44	10·15	75	10·75	15
28	10·30	50	10·70	16	10·40	37	10·40	37	10·3	50	10·70	16
29	10·10	85	10·70	16	10·50	28	10·55	28	10·35	44	10·75	15
30	10·30	50	10·75	15	10·60	22	10·60	25	10·30	50	10·75	15
31	10·35	43	10·75	15	.....	.....	10·55	25	.....	.....	10·75	15

BRANDT CREEK AT MOUTH.

Location.—Section 4, township 7, range 7, west of 7th meridian.

Records Available.—Continuous records since October 19, 1912.

Winter Conditions.—Open water all year.

Gauge.—Vertical staff nailed to tree. Mostly daily readings.

Channel.—Bed of stream covered with rocks, giving a very rough bed. There is ordinarily good control, but there is a possibility of backwater from the Mesliloet river at very high stages.

Discharge Measurements.—One measurement in 1912, and nine in 1913, give good agreement and are well distributed except for high water.

Accuracy.—Accurate except for high stages.

BRANDT CREEK.

Brandt creek rises in the mountains to the east of the Mesliloet river, at an elevation of about 3000 feet, and discharges into the Mesliloet river some 6 miles from its mouth at an elevation of 250 feet. It is part of the Burrard Inlet drainage.

The annual precipitation in the Brandt creek watershed is probably between 120 and 150 inches. In the winter the snowfall is between 2 and 6 feet. In the higher altitudes there are snowfields which remain practically all the year.

At the mouth of the creek the water never freezes over. Higher up, near the mouth of Young creek, there is very little ice, so that open water conditions obtain there also, practically all the year. The heavy snowfall seems to protect the stream from freezing without obstructing the flow to any extent.

The Westminster Power Company proposes to include Brandt creek and its tributaries, Norton and Young creeks, in its high-head development. Norton lake is to be used as a storage and equalizing reservoir, and water is to be diverted into it from upper Brandt creek and from Young lake, as well as from Belknap creek and possibly even Hixon creek. The main pipeline will run from Norton lake to the power plant situated near the mouth of Brandt creek. Wooden pipe will be laid as far as possible on the hydraulic gradient to a small surge reservoir. From that point steel penstocks will be laid to the power-house. This will give a head of about 2000 feet.

Storage dams will be constructed on Young lake, Norton lake and Ann lake. The storage capacity at these three lakes is sufficient to impound practically the whole freshet, and give an equalized flow during the whole year, practically equal to the combined run-off of all the streams. The total amount of water available, while not nearly as great as that of the main Mesliloet river, will yet develop a large amount of power on account of the high head and the good storage facilities.

Gauging stations have been established by this survey at the mouth of Brandt creek and on Brandt creek above Young creek, as well as on the tributaries, Young and Norton creeks. It was hoped that the gauge at the mouth of Brandt would give some idea of the flow at the upper stations, but this has not been found practicable. As soon as facilities are provided for taking more regular gauge readings on the upper stations the station at the mouth of Brandt creek wil be abandoned.

Discharge Measurements of Brandt Creek Mouth, 1912 and 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Oct. 19	C. G. Cline	1,046	30	24·7	1·48	2·02	36·6
1913.							
May 29	H.C. Hughes	1,673	40	52·6	2·32	2·63	122·0
June 9	do	1,673	36	49·3	1·91	2·45	94·0
" 18	do	1,673	36	44·9	1·67	2·35	74·8
" 27	do	1,673	36	53·0	2·18	2·57	115·5
July 3	do	1,673	36	42·2	1·41	2·26	59·1
" 29	do	1,673	19	20·2	0·65	1·62	13·0
Sept. 21	F. MacLachlan	1,673	21	18·7	0·47	1·48	8·8
Nov. 7	do	1,521	41·5	26·9	1·33	2·08	[1]36·3
" 12	do	1,521	40·5	22·9	1·10	1·91	25·1
" 13	do	1,521	40·5	21·3	1·13	1·84	23·8

Note.—[1]Different section.

Monthly Discharge of Brandt Creek Mouth for 1913.

Month.	Discharge in Second-Feet.			Run-off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
January	26	10	16·2	996
February	83	9	24·8	1,380
March	53	12	26·0	1,600
April	165	16	84·8	5,050
May	237	30	124·0	7,620
June	237	65	115·0	6,840
July	174	12	50·7	3,120
August	48	6	10·4	640
September	174	6	34·1	2,030
October	408	8	47·1	408
November	408	14	105·0	6,250
December	246	18	55·0	3,380
The year	408	6	57·8	41,800

Note.—Accuracy "A" and "C".

Monthly Discharge of Brandt Creek Mouth for 1912.

Month.	Discharge in Second-Feet.			Run-off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
November	318	21	113	6,720
December	110	18	38	2,340

Note.—Accuracy "A".

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Daily Gauge Heights and Discharges of Brandt Creek at Mouth for 1912.

Day.	October.		November.		December.	
	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			1·9	26	1·8	21
2			2·1	42		52
3			2·45	92	2·4	83
4			2·25	60	1·85	23
5			2·8	156	1·85	23
6			2·65	129		20
7			2·6	120	1·75	18
8				84	1·75	18
9			2·15	48	1·9	26
10			2·2	53	1·9	26
11			2·6	120	2·25	60
12				120	2·25	60
13				120		71
14			2·6	120	2·4	83
15				129	2·2	53
16				138	2·1	42
17			2·75	147	2·0	33
18			3·7	318	2·55	110
19	2·02	37	3·6	300	2·05	37
20	1·9	26		284	1·95	30
21		42	3·2	228	1·9	26
22		58		169	1·85	28
23		74	2·55	110	1·85	23
24		90	2·55	110	1·85	23
25		106	2·25	60		22
26		122	2·05	37	1·8	21
27	2·7	138	1·95	30	2·1	42
28		111	1·85	23	1·9	26
29		85		22	1·9	26
30		59	1·8	21	1·95	30
31	2·0	33			2·1	42

Daily Gauge Heights and Discharges of Brandt Creek near Mouth for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·8	21		**15**	1·65	14	1·75	18	2·0	33	2·85	165
2	1·8	21	1·65	**14**		15	1·7	16	2·0	33		165
3	1·8	21		13	1·7	16	1·85	23		32	2·85	165
4		19	1·6	12	1·75	18	2·0	33		31	2·65	129
5	1·7	16		12	1·95	30	2·2	53	1·95	30	2·5	161
6		16	1·6	12		36	1·95	30	2·1	42		110
7		16	1·6	12	2·1	42	1·9	26	2·5	101	2·6	120
8		15	1·6	12	2·15	48	1·9	26	2·75	147		106
9		15		11	2·2	53	2·2	53		178	2·45	92
10		14	1·55	10	2·5	33	2·4	83	3·1	210	2·5	101
11		14	1·55	10	2·0	33	2·8	156		192	2·5	101
12		13	1·5	9	2·0	33	2·8	156	2·9	174	2·6	120
13		12	1·5	9		27		124	2·6	150	2·5	101
14		11		24	1·8	21	2·15	92		142	2·4	83
15		11		39	1·8	21		80	2·85	165		106
16		10		54		28	2·3	67		133	2·65	129
17	1·55	10		74		35	2·3	67	2·5	101	2·6	120
18		10	2·4	83	2·1	42	2·6	120	2·5	101	2·35	75
19	1·55	10	2·2	53	1·9	26	2·85	165	2·6	129	2·7	138
20		12		41		25	2·6	120	2·6	120	2·7	138
21		14	1·95	30	1·85	24	2·8	156	2·55	110	3·25	237
22	1·7	16	1·9	26	1·75	18	2·4	183	2·7	138	2·55	110
23		18		24		15	2·2	53	2·9	174	2·45	92
24		21		23	1·6	12	2·7	138	2·85	165		101
25		24	1·8	21		12		138		128	2·55	110
26	1·9	26	1·75	18	1·6	12	2·7	138	2·45	92	2·55	110
27		23	1·7	16	1·6	12		120	3·25	237	2·55	110
28	1·8	21	1·7	16		22	2·5	101		178	2·57	115
29		20			2·0	33		77	2·6	120	2·3	67
30	1·75	18				27	2·0	33		135		95
31	1·7	16			1·8	21				150		

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DAILY GAUGE HEIGHTS AND DISCHARGES of Brandt Creek at Mouth for 1913.
—*Concluded.*

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	63	1·6	12	1·3	6	.....	12	1·95	30	2·25	60
2	.....	61	1·6	12	1·35	6	.....	10	1·75	18	2·1	42
3	2·25	60	.....	12	.....	62	1·5	9	1·65	14	2·05	37
4	2·3	67	1·6	12	.....	118	1·5	9	2·9	174	2·05	37
5	2·35	75	1·45	8	2·9	174	1·45	8	2·4	83	2·05	37
6	2·9	174	1·4	7	2·4	83	1·45	8	2·45	92	2·05	37
7	2·4	83	1·4	7	2·2	53	.....	9	2·68	86	2·25	60
8	2·35	75	1·4	7	2·5	101	1·5	9	2·45	92	2·05	37
9	2·2	53	1·4	7	2·3	57	2·5	9	.....	80	2·0	33
10	2·4	83	.....	7	2·1	42	2·1	42	2·3	67	1·9	26
11	2·15	46	1·4	7	2·1	42	3·0	192	2·1	42	2·6	120
12	2·25	60	1·7	16	1·9	26	4·2	408	1·9	26	2·45	92
13	2·05	37	1·5	9	1·7	16	3·0	192	1·85	24	2·35	75
14	2·0	33	1·5	9	1·65	14	2·45	92	1·75	18	3·3	246
15	2·0	33	.....	9	1·6	12	2·4	83	2·3	67	2·7	138
16	2·0	33	1·5	9	1·6	12	2·17	50	3·0	192	2·4	83
17	2·15	48	1·6	12	1·55	10	2·05	37	2·35	75	2·3	67
18	2·3	67	2·15	48	1·55	10	2·0	33	2·05	37	2·2	53
19	2·3	67	1·8	21	1·5	9	2·0	33	2·13	46	2·0	33
20	.....	60	1·7	16	1·5	9	1·9	26	2·1	42	1·9	26
21	.....	53	1·5	9	.....	10	.....	22	1·9	26	1·8	21
22	.....	45	1·45	8	1·6	12	1·72	17	1·9	26	1·8	21
23	2·05	37	1·45	8	1·5	9	1·9	26	2·2	53	1·8	21
24	2·0	33	1·4	7	1·48	9	1·9	26	4·2	408	1·75	18
25	1·95	30	1·4	7	1·4	7	1·75	18	4·1	390	1·75	18
26	1·85	24	1·4	7	1·4	7	1·65	14	3·5	282	1·75	18
27	1·75	18	1·35	6	1·5	9	1·62	13	3·1	210	2·3	67
28	1·7	16	1·3	6	2·2	53	1·6	12	3·05	200	2·05	37
29	1·62	13	1·3	6	1·8	21	1·6	12	3·2	228	2·0	33
30	.....	13	1·3	6	1·65	14	1·53	10	2·1	83	1·75	18
31	1·6	12	1·3	6	.....	.....	.....	20	.....	.....	2·45	92

BRANDT CREEK ABOVE YOUNG CREEK.

Location.—Section 10, township 7, range 7, west of 7th meridian.

Records Available.—Continuous records since June 1, 1913.

Winter Conditions.—Heavy snowfall but very little ice on the stream. Open water conditions all year.

Gauge.—Vertical staff gauge spiked to tree trunk. Gauge readings once or twice a week.

Channel.—Bed of stream very steep, with rocks and boulders. Water swift at higher stages.

Discharge Measurements.—Six measurements taken during 1913 show good agreement and are well distributed except during high water.

Accuracy.—Infrequency of gauge readings rather impairs accuracy obtained from a good set of meter measurements.

Discharge Measurements of Brandt Creek River above Young Forks, 1913.

Date.	Hydrographer	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
June 3	H. C. Hughes	1,673	11	21·5	3·32	1·70	73·5
" 10	do	1,673	11	16·5	2·24	1·50	37·0
" 18	do	1,673	11	18·0	3·10	1·60	54·2
July 7	do	1,673	10	12·9	1·62	1·30	21·0
" 30	do	1,673	10	8·4	0·56	0·70	[1]4·69
Sept. 23	F. MacLachlan	1,673	9	8·2	0·28	0·51	2·38

Note.—[1]Gauge washed out January, 1913.

Monthly Discharge of Brandt Creek above Young Creek for 1913.

Month.	Discharge in Second-Feet.			Run-off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
June	76·0	22·0	40·9	2,440
July	54·0	7·0	25·5	1,570
August	5·5	1·4	2·58	160
September	6·2	2·6	[2]·9	230
October	220·0	1·5	19·3	1,190
November	22·0	3·0	7·1	422
December	4·1	2·1	3·0	185

Note.—Accuracy "A" and "C".

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Daily Gauge Heights and Discharges of Brandt Creek above Young Creek for 1913.

Day.	June.	
	Gauge Height.	Discharge.
	Feet	Sec. ft.
1		76
2		76
3	1·7	76
4		66
5		56
6		45
7	1·45	34
8		35
9		36
10		38
11	1·5	39
12		33
13		27
14	1·3	22
15		30
16		38
17		46
18	1·6	54
19		49
20		44
21		39
22		34
23	1·4	29
24		27
25	1·35	26
26		27
27		28
28	1·4	29
29		33
30		37
31		

DAILY GAUGE HEIGHTS AND DISCHARGES of Brandt Creek above Young Creek for 1913—*Con.*

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	41	.....	5·0	.....	2·6	0·53	2·8	.....	5·1	.....	4·0
2	.....	45	0·55	3·0	.....	3·4	.....	2·8	.....	7·4	.....	4·0
3	.....	49	.....	3·0	.....	4·2	.....	2·8	.....	9·7	.....	4·0
4	1·6	54	.....	2·5	.....	5·0	.....	2·9	.....	12·0	.....	4·0
5	.....	44	0·50	2·5	.....	5·5	.....	2·9	.....	14·3	0·65	4·1
6	.....	33	.....	2·4	.....	5·9	.....	2·9	.....	16·6	.....	4·0
7	1·3	22	.....	2·3	0·8	6·2	.....	3·0	.....	19·0	.....	3·9
8	.....	25	.....	2·2	.....	6·0	.....	3·0	1·3	22·0	.....	3·8
9	.....	28	0·45	2·1	.....	5·9	0·55	3·0	.....	18·0	.....	3·7
10	.....	31	.....	2·1	.....	5·7	.....	75·0	.....	14·0	.....	3·6
11	.....	35	.....	2·2	0·75	5·5	.....	147·0	.....	10·0	.....	3·5
12	1·5	39	.....	2·2	.....	4·6	2·3	220·0	.....	6·0	.....	3·4
13	.....	31	.....	2·3	.....	3·8	1·45	34·0	0·55	3·0	.....	3·4
14	.....	23	.....	2·4	0·55	3·0	.....	24·2	.....	3·0	.....	3·2
15	1·2	16	.....	2·4	.....	3·0	.....	14·5	.....	3·0	.....	3·1
16	.....	18	0·50	2·5	.....	3·0	0·7	4·8	.....	3·0	.....	3·0
17	.....	19	.....	3·5	.....	2·9	.....	4·7	.....	3·0	.....	2·8
18	.....	21	.....	4·5	.....	2·9	.....	4·6	.....	3·0	.....	2·7
19	1·3	22	0·75	5·5	.....	2·8	.....	4·5	.....	3·0	0·5	2·5
20	.....	22	.....	4·3	.....	2·8	.....	4·4	.....	3·0	.....	2·5
21	.....	22	.....	3·2	.....	2·7	.....	4·2	.....	3·5	.....	2·4
22	.....	22	0·45	2·1	.....	2·7	.....	4·0	.....	3·5	.....	2·4
23	1·3	22	.....	2·0	0·51	2·6	.....	3·9	.....	3·5	.....	2·4
24	.....	20	.....	1·9	.....	2·8	0·61	3·7	.....	3·5	.....	2·3
25	.....	18	.....	1·8	.....	3·0	.....	3·1	.....	3·5	.....	2·3
26	1·2	16	0·4	1·7	.....	3·2	.....	2·7	.....	3·5	.....	2·3
27	.....	14	0·4	1·7	.....	3·4	.....	2·4	.....	3·5	.....	2·2
28	.....	13	.....	1·6	.....	3·6	.....	2·1	.....	3·5	.....	2·2
29	.....	11	.....	1·5	.....	3·8	.....	1·8	.....	3·5	.....	2·2
30	7·0	5	0·37	1·4	0·65	4·1	0·38	1·5	.....	3·5	0·45	2·1
31	.....	7	.....	2·0	.....	.....	.....	3·8	.....	.....	.....	2·1

CHEHALIS RIVER.

Chehalis river has its source in Chehalis lake at an elevation of 700 feet, and discharges into Harrison river near Harrison Mills at an elevation of between 30 and 40 feet. It is part of the Harrison-Fraser drainage; the drainage area, as measured from the Railway Belt map (dated January 1, 1911, scale 7.89 miles per inch) is 200 miles. The annual precipitation is about 80 to 90 inches; there is very heavy snow in winter in all except the lowest parts of the water shed, and the winter conditions are fairly severe. At the mouth, however, the stream is open all the year round.

The Chehalis river, from its source in a rough mountainous country, flows through a wide valley, containing very fine timber, to Chehalis lake. Stadia creek, after tumbling over a 200-foot bluff, enters from the west in this valley. Chehalis lake is a deep mountain lake about 7 miles long, with rocky cliffs rising from the water's edge. It is an excellent storage site for power purposes. The lake is well stocked with fish. At the lower end of the lake there is a large log jam at the mouth of the canyon. A dam could be constructed at any one of a number of good places in this canyon. Five miles below the lake the west fork (Statlu creek) flows into the main river. This creek has no lake on it, and it is much more flashy than the main river.

For the last mile or so of its course the Chehalis flows through a delta, and splits up into a number of sections, with frequent changes of the channel. The deposits from the Chehalis are gradually filling up Harrison bay, and at

low water in the Harrison river very extensive flats are exposed. The flow from Harrison lake through the Harrison river is controlled largely by the bar which the Chehalis has formed across the Harrison. The Harrison river rises and falls with the Fraser river. During the low water this bar on the Harrison at the mouth of the Chehalis is a great hindrance to navigation and logging on the Harrison river, which is the connecting link between the 30 miles of navigation on Harrison lake and the Fraser river tidewater.

To reach the Chehalis river it is necessary to go by water either from Harrison Mills or Harrison Hot Springs; there is no road yet, though surveys have been made for one. From the mouth of the river there is an old logging road for 5 miles to an abandoned logging camp at Boulder creek. This road has been repaired sufficiently for use as a pack trail for horses, and the pack trail has recently been extended to Chehalis lake.

The Chehalis valley was surveyed by A. W. Johnston in 1903 while locating the north limit of the Railway Belt, but with the exception of two ranches on the delta on Harrison bay, none of the country has been settled. It is visited occasionally by timber cruisers and Indians from the reserve at the mouth.

There is a fall of 650 feet between Chehalis lake and the mouth, a distance of 11 miles. There is an excellent storage reservoir in Chehalis lake.

The river station was established November 4, 1911, by C. G. Cline. It is located a mile and a half from the mouth opposite the foot of the first hill on the trail up the river. A chain gauge, supported from a pole fastened to two trees, is located on the right bank; its datum is referred to three bench-marks. Measurements are made by wading, except at high water, when cable measurements are made from a canoe, one quarter of a mile below the gauge. The measuring section is fair; the control is good, the banks high on one side, current uniform, and one channel at low water. At high water, however, the river overflows its left bank and forms two channels. The bed of the stream is liable to cut and shift, especially during the freshet.

The power possibilities of Chehalis river are being investigated by the Vancouver Power Company. The Canadian Pacific Railway at one time made application for power privileges on the river.

CHEHALIS RIVER.

Location.—One and a half miles from mouth in section 14, township 4, range 30, west of 6th meridian.

Records Available.—November and December, 1911; March 8 to December 31, 1912; January 1 to December 31, 1913.

Winter Conditions.—Open water at gauging station all year.

Gauge.—Chain gauge suspended over river by pole spiked to two trees on the bank.

Channel.—Rocky bed, permanent channel, water swift at higher stages.

Discharge Measurements.—Two in 1911, five in 1912, and two in 1913 agree fairly well, and cover all but the highest and lowest stages.

Accuracy.—Fair.

Discharge Measurements of Chehalis River 1½ miles from mouth, 1911, 1912, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Nov. 3	C. G. Cline	1,053	73	127	1·05	0·85	133[1]
Dec. 14	H. M Smith	1,057	105	273	3·74	3·80	1,021[2]
1912.							
Mar. 8	C. G. Cline	1,046	110	162	1·82	2·70	295[3]
July 15	do	1,946	123	221	2·42	3·07	535[3]
Sept. 11	do	1,046	105	248	2·40	2·90	594[3]
Nov. 23	do	1,048	140	600	4·85	4·95	2,910[3]
Dec. 4	do	1,048	130	343	3·56	3·92	1,220[3]
1913.							
May 21	do	1,044	145	460	3·90	4·40	1,810[3]
Sept. 8	do	1,055	145	395	3·95	4·40	1,560[3]

Note.—[1] Old staff gauge. [2] New staff gauge. [3] Chain gauge.

Monthly Discharge of Chehalis River 1½ miles from mouth for 1913.

[Drainage area, 200 square miles.]

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	1,230	270	551	2·76	3·18	33,900
February	12,500	340	1,350	6·75	7·03	75,000
March	3,100	580	1,084	5·42	6·25	66,600
April	3,450	710	1,465	7·32	8·17	87,000
May	5,550	1,100	2,466	12·30	14·18	151,300
June	2,200	1,430	1,693	8·47	9·45	100,800
July	1,550	450	916	4·58	5·28	56,300
August	750	230	441	2·20	2·54	27,100
September	4,850	250	1,010	5·05	5·63	60,100
October	7,700	270	1,765	8·82	10·17	108,500
November	15,000	420	3,295	16·48	18·40	195,800
December	4,350	820	1,615	8·08	9·32	99,300
The year period	15,000	230	1,467	7·35	99·60	1,061,700

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Daily Gauge Heights and Discharges of Chehalis River $1\frac{1}{2}$ miles from Mouth for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	3·6	900	3·2	600	3·4	750	3·7	980	4·25	1,490	4·7	2,200
2	3·6	900	3·25	630	3·4	750	3·6	900	2·15	1,380	4·7	2,200
3	3·5	820	3·1	540	3·4	750	3·4	750	4·1	1,320	4·6	2,000
4	3·35	710	2·9	480	3·5	820	3·35	710	4·05	1,270	4·55	1,910
5	3·3	670	3·0	480	3·6	900	3·4	750	4·05	1,270	4·5	1,820
6	3·2	600	2·9	420	3·8	1,060	3·4	750	3·85	1,100	4·4	1,670
7	3·15	570	2·9	480	3·8	1,060	3·45	790	4·35	1,610	4·4	1,670
8	3·1	540	3·0	480	3·6	900	3·5	820	4·55	1,910	4·5	1,820
9	3·0	489	2·9	420	3·5	820	3·5	820	4·95	2,920	4·4	1,670
10	2·9	420	2·8	360	3·6	900	3·8	1,060	4·85	2,600	4·3	1,550
11	2·85	390	2·8	360	3·5	820	4·2	1,430	4·95	2,920	4·4	1,670
12	2·75	340	2·75	340	3·6	900	4·3	1,550	5·25	4,100	4·5	1,820
13	2·7	310	2·8	360	3·7	980	4·45	1,750	5·35	4,600	4·35	1,610
14	2·7	310	2·9	420	3·7	980	4·3	1,550	5·45	5,100	4·3	1,550
15	2·6	270	3·9	1,140	3·7	980	4·2	1,430	5·55	5,550	4·4	1,670
16	2·6	270	7·0	12,500	3·8	1,060	4·1	1,320	5·25	4,100	4·4	1,670
17	2·6	270	5·5	5,300	5·0	3,100	4·2	1,430	5·05	3,280	4·3	1,550
18	2·6	270	4·9	2,750	4·7	2,200	4·3	1,550	4·65	2,100	4·3	1,550
19	2·6	270	4·5	1,820	4·5	1,820	4·6	2,000	4·55	1,910	4·4	1,670
20	2·7	310	4·2	1,430	4·3	1,550	4·65	2,100	4·45	1,750	4·5	1,820
21	2·7	310	3·9	1,140	3·95	1,180	5·1	3,450	4·4	1,670	4·4	1,670
22	2·8	360	3·7	980	3·65	940	4·9	2,750	4·2	1,430	4·5	1,820
23	2·7	310	3·5	820	3·4	750	4·75	2,320	4·3	1,550	4·4	1,670
24	3·3	676	3·45	789	3·15	580	4·4	1,670	4·4	1,670	4·3	1,550
25	4·0	1,230	3·4	750	3·3	670	4·3	1,550	4·6	2,000	4·3	1,550
26	3·7	980	3·35	710	3·2	600	4·45	1,750	4·9	2,750	4·25	1,490
27	3·5	820	3·3	670	3·5	820	4·4	1,670	5·3	4,350	4·2	1,430
28	3·4	750	3·3	670	3·7	980	4·3	1,550	4·9	2,750	4·3	1,550
29	3·4	750			4·2	1,430	4·2	1,430	4·6	2,000	4·25	1,490
30	3·3	670			4·2	1,430	4·15	1,380	4·5	1,820	4·25	1,490
31	3·2	600			3·9	1,140			4·6	2,000		

DAILY GAUGE HEIGHTS AND DISCHARGES of Chehalis River 1½ miles from mouth for 1913—Con.

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	4·0	1,230	3·0	480	2·6	270	2·7	316	2·9	420	4·8	2,450
2	3·9	1,140	2·9	420	2·7	310	2·7	310	3·0	480	4·6	2,000
3	4·0	1,230	2·85	390	4·7	2,200	2·6	270	3·1	540	4·45	1,750
4	4·0	1,230	2·85	390	5·4	4,850	2·6	270	4·3	1,550	4·3	1,550
5	4·2	1,430	2·9	420	5·0	3,100	2·6	270	4·0	1,230	4·2	1,430
6	4·0	1,230	3·0	480	4·6	2,600	2·7	310	4·1	1,320	4·1	1,320
7	4·0	1,230	3·0	480	4·2	1,430	3·8	1,060	4·2	1,430	4·5	1,820
8	4·1	1,320	2·9	420	4·3	1,550	3·9	1,140	4·9	2,750	4·3	1,550
9	4·2	1,430	2·8	360	4·4	1,670	4·2	1,430	4·9	2,750	4·1	1,320
10	4·3	1,550	2·9	420	4·2	1,430	5·0	3,100	5·2	3,850	4·0	1,230
11	4·2	1,430	2·8	360	4·0	1,230	5·2	3,850	4·6	2,000	3·85	1,100
12	4·1	1,320	3·2	600	3·9	1,140	5·6	5,800	4·3	1,550	3·7	980
13	3·8	1,060	3·1	540	3·7	980	6·0	7,700	4·1	1,320	3·6	900
14	3·8	1,060	3·1	540	3·55	860	5·7	6,250	4·2	1,430	3·9	1,140
15	3·6	900	3·0	480	3·4	750	5·3	4,350	4·55	1,910	5·3	4,350
16	3·5	820	2·9	420	3·3	670	5·0	3,100	7·2	13,500	5·0	3,100
17	3·4	750	3·2	600	3·15	570	4·6	2,600	5·1	3,450	4·8	2,450
18	3·35	710	3·4	750	3·0	480	4·7	2,200	4·9	2,750	4·6	2,000
19	3·3	670	3·2	600	2·9	420	4·6	2,000	4·9	2,750	4·3	1,550
20	3·25	630	3·1	540	2·8	360	3·8	1,060	4·8	2,450	4·1	1,320
21	3·1	540	3·1	540	2·8	360	3·7	980	4·5	1,820	4·0	1,230
22	3·0	480	3·0	480	2·7	310	3·7	980	4·2	1,430	3·9	1,140
23	2·95	450	2·9	420	2·6	270	3·65	940	4·2	1,430	3·8	1,060
24	3·2	600	2·85	390	2·6	270	3·5	820	7·5	15,000	3·7	980
35	3·3	670	2·8	360	2·55	250	3·4	750	6·1	8,200	3·6	900
26	3·2	600	2·75	340	2·6	270	3·3	670	5·6	5,800	3·5	820
27	3·2	600	2·9	420	2·6	270	3·3	670	5·4	4,850	3·5	820
28	3·1	540	2·65	290	3·4	750	3·2	600	5·3	4,350	4·8	2,450
29	3·1	540	2·6	270	3·3	670	3·1	540	5·1	3,450	4·65	2,100
30	3·0	480	2·55	250	3·2	600	3·05	510	5·0	3,100	4·5	1,820
31	3·1	540	2·5	230	.....	.....	3·0	480	.....	.....	4·2	1,430

CHILLIWACK RIVER.

Location.—Five miles above Sumas lake in section 1, township 23, east of Coast meridian.

Records Available.—Continuous since 1911.

Winter Conditions.—Open water at gauging station all year.

Gauge.—Vertical staff gauge on rock-filled crib, Gauge readings daily.

Channel.—Rocky bottom, water deep, swift at higher stages, good control.

Discharge Measurements.—Eight measurements during 1911, 1912, and 1913 show good agreement and are fairly will distributed.

Accuracy.—Results are quite accurate.

CHILLIWACK RIVER.

The Chilliwack river has its source in Chilliwack lake at an elevation of 2,080 feet. It passes through the Vedder river channel and empties into Sumas lake, which is less than 100 feet above sea-level. The drainage area is about 450 square miles, about one-quarter of which lies in the state of Washington The district is very humid, the precipitation being from 40 inches to 70 inches per annum. The water is at present unused, but there are power possibilities on the stream.

Chilliwak River—Metering Station at Indian Dug out.

The control of the flow of this river is of great importance in connection with the Sumas Dyking Project. The Chilliwack river is subject to severe floods, and owing to its flat grade on the lower reaches, is a source of considerable damage to the rich farming districts in that locality. For the upper two-thirds of its length the river is separated from the valley of the Fraser by the Cheam mountains, the highest peak of which rises to an elevation of 9,000 feet. Opposite, on the south, mount Baker rises abruptly to an even greater height. The bottom slopes of the valley are well covered with timber, some of it of excellent quality. A wagon road has been constructed from the lower end of

Chilliwak River, looking downstream past Gauging Station.

the valley, near Chilliwack, some 8 miles up the river; beyond this there is evidence of an old trail very much overgrown, and impassible in many places. The slopes of the valley in its lower reaches are characterized by high bluffs of sedimentary or glacial origin subject to enormous slides or slips. The stream has a fast current and its bed is composed of large boulders that have been washed out of the many slides along its course. The elevation of Chilliwack lake is 2,080 feet, the shores and adjacent slopes being covered with alder and brush. The lake has an area of about 2,600 acres.

The lower reaches of this river seem to have been changed very much due to dykes and other artificial conditions. Previously it seems to have spread over the country in a number of channels, most of which finally found their way to the Fraser.

The Chilliwack river used to flow through what is now called the Luckakuck channel to the Fraser. Some twenty years ago the river was dammed and diverted by the residents living along that channel (near Sardis) and made to flow through the channel of Vedder creek into Sumas lake, and indeed the Chilliwack is locally referred to as the Vedder river.

There are excellent power possibilities on the Chilliwack river, but on account of inaccessibility and the probable high cost of development they have not been carefully investigated.

The station was established on November 14, 1911, by K. H. Smith. It is located about 6 miles from the town of Chilliwack and about 300 yards above the highway bridge known as the Vedder river crossing. The gauge is a standard vertical staff gauge, 8 feet long, and is attached to a rock-filled crib.

Measurements are made by current-meter from a canoe held in place by a cable attached to the cribbing to which the gauge is secured, or by using a special traveller on the cable and suspending the meter from it.

The banks are moderately high and are protected by timber cribbing, confining the stream to a single channel.

There are two bench-marks which are referred to the datum of the gauge.

DISCHARGE MEASUREMENTS of Chilliwack River near Vedder River Hotel, 1911-14.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft per sec.	Feet.	Sec.-ft.
1911.							
Dec. 18	Smith	1,057	76	451·2	2·61	1·70	1,180
1912.							
Mar. 21	C. G. Cline	1,046	65	424·0	1·76	1·00	750
" 22	do	1,046	65	508·5	1·52	1·00	770
July 8	do	1,046	85	658·0	4·69	2·90	3,090
Aug. 30	do	1,046	65	552·0	2·03	1·60	1,120
Nov. 21	do	1,048	85	684·0	5·32	3·15	3,640
1913.							
June 5	H. G. Chisholm	1,044	165	969·0	8·90	5·00	8,640
July 13	H. J. E. Keys	1,055	155	710·0	7·41	4·05	5,270
1914.							
Jan. 10	H. J. E. Keys	1,046	110	816·0	5·47	3·65	4,450
" 13	do	1,046	100	718·0	4·31	2·80	3,090
" 12	do	1,046	105	740·0	4·49	2·98	3,320
" 15	do	1,046	95	796·0	3·70	2·70	2,920
" 17	do	1,046	95	780·0	3·27	2·54	2,550

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Monthly Discharge of Chilliwack River near Mouth for 1913.

(Drainage area, 450 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	1,360	960	1,208	2·68	3·09	74,400
February	10,100	815	1,942	4·31	4·49	108,000
March	1,160	1,020	1,064	2·37	2·73	65,400
April	3,260	960	1,557	3·47	3·87	92,600
May	8,900	1,500	4,416	9·81	11·31	272,000
June	12,260	5,920	4,779	10·62	11·85	284,000
July	8,100	3,620	5,724	12·72	14·64	352,000
August	3,440	1,250	2,302	5·12	5·90	141,000
September	8,500	1,250	2,664	5·93	6·62	158,000
October	10,500	960	2,770	6·16	7·10	170,000
November	5,360	1,500	2,533	5·63	6·28	150,000
December	2,750	960	1,557	3·46	3·99	95,600
The year	12,200	815	2,710	6·02	81·87	1,963,000

Note.—Accuracy "A".

Daily Guage Heights and Discharges of Chilliwack River near Mouth for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·7	1,250	1·3	960	1·4	1,020	1·35	990	2·2	1,910	5·0	8,900
2	1·7	1,250	1·3	960	1·4	1,020	1·35	990	2·0	1,620	5·85	12,200
3	1·7	1,250	1·3	960	1·4	1,020	1·3	960	1·95	1,565	5·8	12,000
4	1·7	1,250	1·3	960	1·4	1,020	1·3	960	2·0	1,620	5·7	11,600
5	1·8	1,360	1·25	930	1·4	1,020	1·3	960	1·9	1,500	5·2	9,700
6	1·8	1,360	1·25	930	1·5	1,080	1·3	960	2·0	1,620	4·85	8,300
7	1·7	1,250	1·20	900	1·5	1,080	1·3	960	2·2	1,910	4·95	8,700
8	1·7	1,250	1·20	900	1·5	1,080	1·3	960	2·9	3,090	5·2	9,700
9	1·7	1,250	1·1	840	1·5	1,080	1·3	960	3·5	4,200	5·0	8,900
10	1·7	1,250	1·1	840	1·5	1,080	1·35	990	3·7	4,600	4·6	7,340
11	1·7	1,250	1·1	840	1·5	1,080	1·7	1,250	3·3	3,800	4·4	6,600
12	1·7	1,250	1·1	840	1·5	1,080	2·3	2,070	3·4	4,030	4·5	6,970
13	1·7	1,250	1·05	815	1·5	1,080	2·25	1,990	3·5	4,200	5·4	10,500
14	1·7	1,250	1·05	815	1·5	1,080	2·2	1,910	3·4	4,000	5·0	8,900
15	1·7	1,250	2·1	1,760	1·5	1,080	2·3	2,070	3·3	3,800	4·5	6,970
16	1·7	1,250	4·6	7,340	1·5	1,080	2·2	1,910	3·4	4,000	4·4	6,600
17	1·7	1,250	5·3	10,100	1·55	1,120	2·0	1,620	3·2	3,620	4·3	6,250
18	1·7	1,250	3·6	4,400	1·6	1,160	2·3	2,070	3·0	3,260	4·2	5,920
19	1·7	1,250	2·8	2,920	1·6	1,160	2·5	2,410	3·1	3,440	4·6	7,340
20	1·7	1,250	2·7	2,750	1·5	1,080	2·8	2,920	3·2	3,620	5·2	9,700
21	1·6	1,160	2·4	2,240	1·5	1,080	3·0	3,260	3·4	4,000	4·8	8,100
22	1·6	1,160	2·1	1,760	1·5	1,080	2·9	3,090	3·8	4,840	4·6	7,340
23	1·6	1,160	2·0	1,620	1·5	1,080	2·8	2,920	4·22	5,920	4·55	7,159
24	1·65	1,200	1·9	1,500	1·5	1,080	2·9	3,090	4·3	6,250	4·5	6,970
25	1·65	1,200	1·9	1,500	1·4	1,020	2·6	2,580	4·1	6,600	4·55	6,800
26	1·6	1,160	1·7	1,250	1·1	1,020	2·7	2,750	4·8	8,100	4·4	6,600
27	1·6	1,160	1·5	1,080	1·4	1,020	2·5	2,410	5·1	8,900	4·5	6,970
28	1·5	1,080	1·5	1,080	1·4	1,020	2·45	2,325	4·9	8,500	4·45	6,809
29	1·4	1,020			1·4	1,020	2·4	2,240	4·7	7,720	4·4	6,600
30	1·3	960			1·1	1,020	2·3	2,070	4·5	6,970	4·5	6,970
31	1·3	960							4·7	7,720		

DAILY GAUGE HEIGHTS AND DISCHARGES of Chilliwack River near Mouth for 1913—*Concluded.*

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	4·6	7,340	3·1	3,440	1·8	1,360	1·7	1,250	2·2	1,910	2·7	2,750
2	4·4	6,600	3·1	3,440	1·7	1,250	1·7	1,250	2·0	1,620	2·6	2,580
3	4·2	5,920	3·0	3,260	2·0	1,620	1·6	1,160	1·9	1,500	2·5	2,410
4	3·9	5,100	3·1	3,440	4·9	8,500	1·5	1,080	2·0	1,620	2·4	2,240
5	4·0	5,360	3·0	3,260	4·7	7,720	1·4	1,020	2·2	1,910	2·3	2,070
6	4·4	6,600	2·9	3,090	4·0	5,360	1·4	1,020	2·1	1,760	2·2	1,910
7	4·8	8,100	3·0	3,260	3·8	4,840	1·3	960	2·0	1,620	2·3	2,070
8	4·6	7,340	2·9	3,090	3·4	4,000	1·3	960	2·1	1,760	2·3	2,070
9	4·4	6,600	2·8	2,920	3·1	3,440	1·4	1,020	2·4	2,240	2·2	1,910
10	4·5	6,970	2·7	2,750	2·8	2,920	1·5	1,080	2·3	2,070	2·2	1,910
11	4·7	7,720	2·8	2,920	2·7	2,750	5·4	10,500	2·2	1,910	2·1	1,760
12	4·5	6,970	2·7	2,750	2·6	2,580	4·4	6,600	2·1	1,760	2·0	1,620
13	4·1	5,620	2·6	2,580	2·5	2,410	4·9	8,500	2·0	1,620	1·9	1,500
14	3·8	4,840	2·7	2,750	2·4	2,240	3·9	5,100	1·9	1,500	2·0	1,620
15	3·6	4,400	2·5	2,410	2·3	2,070	3·5	4,200	1·9	1,500	2·1	1,760
16	3·5	4,200	2·2	1,910	2·2	1,910	3·2	3,620	3·7	4,600	1·8	1,360
17	3·4	4,000	2·3	2,070	2·4	2,240	3·0	3,260	3·2	3,620	1·9	1,500
18	3·6	4,400	2·3	2,070	2·7	2,750	2·8	2,920	3·8	2,920	1·8	1,360
19	4·1	5,620	2·2	1,910	2·1	1,760	2·7	2,750	2·7	2,750	1·7	1,250
20	4·3	6,250	2·1	1,760	2·1	1,760	2·6	2,580	2·5	2,410	1·6	1,160
21	4·6	7,340	1·9	1,500	2·2	1,910	2·7	2,750	2·4	2,240	1·5	1,080
22	4·5	6,970	1·8	1,360	2·2	1,910	2·6	2,580	2·3	2,070	1·6	1,160
23	4·4	6,600	1·7	1,250	2·1	1,760	2·7	2,750	2·2	1,910	1·5	1,080
24	4·2	5,920	1·9	1,500	2·1	1,760	3·0	2,070	4·0	5,360	1·4	1,020
25	4·0	5,360	2·0	1,620	2·0	1,620	2·7	2,750	3·7	4,600	1·5	1,080
26	3·9	5,100	1·9	1,500	1·9	1,500	2·5	2,410	3·3	3,800	1·4	1,020
27	3·7	4,600	1·8	1,360	1·8	1,360	2·4	2,240	3·3	3,800	1·4	1,020
28	3·5	4,200	2·0	1,620	2·1	1,760	2·3	2,070	3·0	3,260	1·5	1,080
29	3·4	4,000	1·9	1,500	1·9	1,500	2·2	1,910	3·0	3,260	1·4	1,020
30	3·3	3,800	2·0	1,620	1·8	1,360	2·1	1,760	2·9	3,090	1·3	960
31	3·2	3,620	1·9	1,500	.....	.....	2·1	1,760	.....	.....	1·3	960

COQUIHALLA RIVER.

Location.—Near mouth of river and town of Hope, in section 10, township 5, range 26, west of 6th meridian.

Records Available.—Continuous records since November 16, 1911.

Winter Conditions.—Open water at gauging station all year.

Gauge.—Chain gauge on highway bridge; gauge readings two or three times a week. Some trouble with gauge chain stretching.

Channel.—Bottom rocky and streams rather shallow. Water swift at the higher stages.

Discharge Measurements.—Eleven meter measurements during 1912 and 1913 show some discrepancies, and do not cover highest stages.

Accuracy.—Records only moderately accurate on account of infrequency of gauge readings and a number of changes in the length of the chain.

COQUIHALLA RIVER.

Coquihalla river has its source in the pass betwen the Coquihalla and Coldwater rivers, at an elevation of 3,000 feet, and discharges into the Fraser river near Hope at an elevation of 120 feet. It is part of the Fraser drainage; the drainage area, as measured from a Dominion sectional map, scale 3 miles to an inch, is 360 square miles. The annual precipitation varies from 50 inches

at the mouth to about 80 inches at the headwaters. At Hope the winters are quite mild, and the stream does not freeze over. In the higher altitudes the winters are much more severe.

The following tributaries enter from the left going upstream; the Kawkaw, Ladner, and Boston Bar creeks; Nicolum creek and Pierra river enter from the right.

Just above the mouth of the Nicolum, and about 6 miles from the Fraser is the site of a proposed power development, about 1½ acres in extent. The river flows through a gorge with preciptous rocky walls from 30 to 70 feet in width, and about 150 feet in height. By constructing a dam at the head of the gorge, and a tunnel through the mountains for about 1,000 feet to the power site, from 100 to 125 feet head could be obtained. Storage facilities, however, are undefined, as yet and may be limited by the railroad construction in the valley. A few hundred feet below the mouth of the Nicolum, there is another small canyon and falls; but to use this section of the river in conjunction with the other would be very expensive.

The river station on the Coquihalla was established April 10, 1912, by C. G. Cline. It is located at the upper highway bridge, a mile from the mouth. A chain gauge 24 feet long is attached to the middle of the bridge on the downstream side, and its datum is referred to three bench-marks. Cable measurements are made from the down stream side of the bridge. The control is good, the banks are high, the current fairly uniform, and the stream has a permanent rocky channel. In the freshet season the water might flow in two channels, but entirely under the bridge.

DISCHARGE MEASUREMENTS of Coquihalla River near Mouth 1911, 1912 and 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Nov. 16	C. G. Cline					1·15	[1]333
Dec. 12	K. H. Smith					2·05	[1]1,220
1912.							
Feb. 29	C. G. Cline					1·25	[1]422
	New Gauge established April 10, 1912.						
June 8	Cline, Carbould	1,046	149	597	4·8	3·30	[2]2,880
" 29	C. G. Cline	1,046	122	275	3·2	1·90	890
Sept. 13	do	1,046	110	171	2·0	1·05	334
Nov. 15	do	1,048	120	276	2·8	1·65	762
" 18	do	1,048	120	350	3·5	2·25	1,210
" 20	do	1,048	120	386	3·9	2·45	1,510
1913.							
May 12	C. G. C. & K. G. C	1,044	150	576	5·7	3·50	3,140
June 21	C. G. C. & K. G. C	1,044	154	540	5·8	3·65	3,040
July 21	K. G. Chisholm	1,055	122	378	3·7	2·60	1,410
Sept. 9	K. G. C. & F. MacL	1,055	119	383	3·7	2·70	1,440
Oct 13	H. J. E. Keys	1,057	129	524	6·0	3·47	3,160

NOTE.—[1] Old gauge. [2] New gauge.

Monthly Discharge of Coquihalla River near Mouth for 1913.

(Drainage area, 360 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	1,580	320	557	1·55	1·79	34,200
February	2,400	250	592	1·64	1·71	32,900
March	560	270	391	1·08	1·25	24,000
April	2,310	230	1,195	3·32	3·70	70,800
May	6,070	890	3,330	9·25	10·66	20,500
June	7,040	2,480	3,961	11·00	12·27	203,500
July	2,480	850	1,705	4·74	5·46	104,500
August	970	330	580	1·63	1·88	35,700
September	3,110	320	1,000	2·78	3·10	59,509
October	5,690	320	1,665	4·62	5·33	102,000
November	2,310	770	1,243	3·45	3·85	73,830
December	1,240	470	719	2·00	2·31	44,200
The year	7,040	230	1,412	3·92	53·31	1,022,000

Note.—Accuracy "A", "B" and "C".

Daily Guage Heights and Discharges of Coquihalla River near Mouth for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·1	370	1·0	320	1·0	320	.....	270	.....	1,050	.....	6,370
2	.....	370	.....	320	.....	320	0·8	240	.....	970	5·6	7,040
3	.....	370	1·0	320	1·0	320	.....	240	1·9	890	5·5	6,840
4	1·1	370	.....	300	.....	320	0·75	230	.....	900	.....	5,640
5	.....	350	.....	280	1·0	320	.....	230	.....	910	4·25	4,450
6	1·0	320	0·9	270	1·05	350	.....	240	1·95	930	.....	4,500
7	.....	370	.....	320	.....	440	0·8	240	.....	1,430	4·3	4,550
8	1·2	420	1·1	370	1·4	530	.....	310	2·9	2,000	.....	4,350
9	1·05	350	.....	400	.....	550	.....	390	.....	3,000	4·1	4,160
10	.....	350	.....	440	1·45	560	1·3	470	4·0	3,960	4·3	4,550
11	1·05	350	1·3	470	1·3	470	.....	910	.....	3,590	.....	4,350
12	.....	430	0·9	270	.....	470	2·4	1,340	.....	3,210	4·1	4,160
13	.....	510	0·85	250	1·3	470	.....	1,370	3·4	2,840	.....	3,690
14	1·5	590	.....	510	.....	420	2·45	1,400	.....	2,730	.....	3,220
15	.....	640	1·75	770	1·1	370	2·45	1,400	.....	2,620	3·35	2,750
16	1·65	690	.....	1,580	.....	450	.....	1,600	.....	2,480	.....	3,110
17	.....	750	3·15	2,400	1·4	530	.....	1,800	3·1	2,310	.....	3,470
18	1·8	810	.....	1,660	1·4	530	.....	1,980	.....	2,440	.....	3,830
19	.....	1,050	1·95	930	.....	480	.....	2,180	3·3	2,660	.....	4,190
20	.....	1,280	.....	780	.....	430	3·1	2,310	.....	3,360	4·3	4,550
21	2·6	1,580	1·55	630	1·1	370	.....	2,310	.....	4,060	3·7	3,390
22	.....	1,100	.....	560	1·1	370	3·1	2,310	.....	4,760	.....	3,210
23	1·55	630	.....	480	.....	340	.....	2,010	4·75	5,410	.....	3,030
24	1·15	460	1·15	400	1·0	320	.....	1,700	4·85	5,600	.....	2,840
25	1·15	460	.....	400	.....	320	2·4	1,340	4·85	5,600	3·3	2,660
26	.....	460	.....	460	1·0	320	2·6	1,580	5·1	6,970	.....	2,780
27	1·15	400	1·15	400	0·95	300	2·7	1,710	.....	5,820	.....	2,900
28	.....	410	.....	360	0·9	270	2·4	1,340	.....	5,570	3·5	3,020
29	1·2	420	.....	.....	.....	280	.....	1,240	.....	5,320	.....	2,750
30	1·2	420	.....	.....	.....	290	2·2	1,150	4·55	5,030	3·2	2,480
31	.....	370	.....	.....	0·95	300	.....	.....	.....	5,700	.....	.....

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DAILY GAUGE HEIGHTS AND DISCHARGES of Coquihalla River near Mouth for 1913—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	3·2	2,480		790	1·0	320		380	2·1	1,060	2·3	1,240
2		2,480	1·7	730		320		390	1·9	890	2·1	1,060
3		2,480		700	1·0	320		400		905		1,030
4		2,480		680		1,710	1·15	403		920		1,000
5	3·2	2,480		660	3·55	3,110		370	1·95	939		970
6		2,480		640		2,880		350		890		940
7	3·2	2,480	1·55	620		2,480	1·0	320		850		920
8	2·9	2,000	1·75	770		2,160		1,670	1·8	810		890
9	2·75	1,780	1·55	620	2·7	1,710		3,010		810		860
10		1,850		570		1,600		4,350		800		830
11		1,920	1·4	530	2·4	1,340	4·9	5,690		790		800
12	2·9	2,000	1·5	590		1,190		4,440		790		780
13		1,820	1·4	530		1,040	3·6	3,200		780		760
14		1,640	1·75	770	1·9	890		2,460	1·75	770		740
15	2·5	1,460		620	1·8	810	2·7	1,710		929	1·7	730
16		1,550	1·3	470		760	2·45	1,400		1,670	1·6	600
17		1,650	2·0	970		719		1,320		1,220		630
18		1,750		850	1·6	660	2·3	6,240		1,370		600
19	2·8	1,850		720		640	2·6	1,580		1,520		570
20	2·75	1,780	1·5	590		629	2·65	1,640		1,670		540
21	2·6	1,580		550		600		1,610		1,820	1·35	560
22		1,510		510		580		1,570		1,970	1·47	570
23		1,370	1·3	470	1·45	560		1,551		2,120		560
24		1,240	1·3	479		520		1,520	3·1	2,319		550
25		1,100	1·2	420		480		1,500		1,950		540
26	2·0	970		400		450		1,480	2·6	1,589	1·4	530
27		1,000	1·1	370	1·2	426	2·5	1,460		1,530		520
28	2·05	1,029		360		400	2·2	1,150		1,480		510
29		960		350		390	2·25	1,190		1,420		500
30		900		346	1·1	370		1,150		1,340		485
31		850		330				1,100			1·3	470

COQUITLAM RIVER.

Location.—Discharge measured at lower end of tunnel to lake Buntzen, in township 5, range 6, west of 7th meridian.

Records Available.—Average run-off from 1906 to 1913.

Winter Conditions.—Open water.

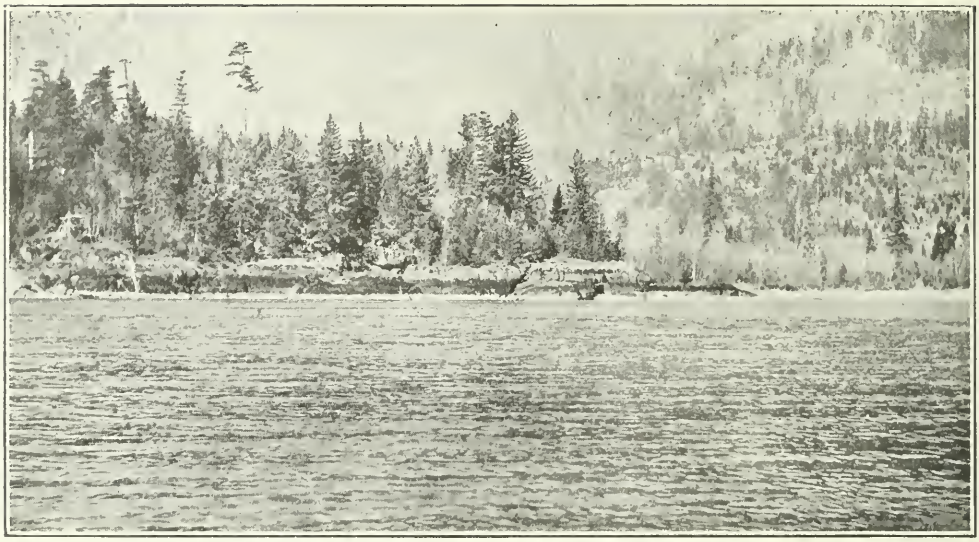
Gauge.—Staff gauge for weir measurments.

Channel.—Artificial.

Discharge Measurements.—Weir measurements made by engineers of Vancouver Power Company.

COQUITLAM RIVER.

Coquitlam river rises in Disappointment lake near the north boundary of the Railway Belt in township 7, range 6, west of the 6th meridian. Coquitlam lake is on the river about 8 miles farther south, in township 5, range 6. It is at an elevation of 430 feet, and has an area of 2,300 acres at low water. Below Coquitlam lake the river flows south for about 10 miles and discharges into Fraser river near the mouth of Pitt river in township 38 E.C.M. Gold creek enters the river from the east below the lake, and Viola creek empties into the lake itself, also from the east. The drainage area above the outlet of the lake is 105 square miles.



Fraser River at Hope, B.C. Gauge painted on Rock face.

Coquitlam watershed is in the Coast district. The mean annual precipitation near the mouth is 60 inches. There is very little snow at the mouth, and the river rarely freezes over there. At the lake, however, the snowfall is very heavy, and the lake is frozen for several months. There the precipitation is about 140 inches, and it is probably more in the higher altitudes. Snow remains on the mountain peaks practically all summer.

The Vancouver Power Company uses the water of Coquitlam river for developing power for Vancouver, New Westminster, and vicinity. The city of New Westminster gets its water supply from Coquitlam lake, and conveys it by pipes to the city. The amount of water the city uses does not seriously

Fraser River at Hope, B.C. Looking upstream from Gauge.

affect the supply for power, but it is necessary, above all things, to keep the water clean and pure and to provide for a continuous flow under all circumstances. These conditions made it necessary to establish a Government reserve around the lake and its headwaters, and to have a Government inspecting engineer on the ground during the construction of the works for the power company.

In developing power the water is diverted from Coquitlam lake to lake Buntzen, and from there it is carried in pressure pipes to the power-house on the North Arm of Burrard inlet. Water is stored in Coquitlam lake by means of a large hydraulic-fill earth dam which is capable of raising the level of the lake 50 feet. The connection between the two lakes is made by a tunnel 12,775 feet long which passes under a mountain about 4,000 feet high. Lake Buntzen makes a good equalizing reservoir, having an area of 500 acres. It is 400 feet above sea-level. At its outlet there is a concrete dam 54 feet high and 360 feet long. The pipelines from the dam to the power-house are 1,800 feet long. The upper 800 feet of each line is a wooden stave pipe with a diameter of 54 inches, and the lower 1,000 feet is of riveted steel construction, varying in diameter from 48 inches. The power-house is at sea-level, and is built of stone with a concrete foundation. On account of the high head of 400 feet, it is possible to use the tangential type of water wheel. Pelton and Doble wheels of different capacities are used, and are direct connected to their generators.

A gauging station was maintained for a few months on the Coquitlam river just above the lake, and another on Viola creek. It was the intention to combine the results obtained at these two stations, which should give very nearly the amount of water available for power, as the other streams which flow into the lake would probably provide enough water for New Westminster. The stations were maintained as long as there was a gauge reader available. The flow is now determined by a weir which the Vancouver Power Company has installed at the outlet of the tunnel. This station does not take account of the overflow over the storage dam at the lower end of lake Coquitlam, but it is not expected that there will be much overflow except possibly during the summer freshet.

Below the dam, the stream will be practically dry most of the year, but the flow of Gold creek, which enters about a mile below the dam, will probably supply sufficient water for all necessary purposes on the lower river. A gauging station is being maintained on Gold creek to measure its flow.

MONTHLY DISCHARGE of Coquitlam River at outlet of Vancouver Power Company's Tunnel for 1913.

	Mean Discharge in Second-Feet	Run-Off. Total in acre-feet.
1913	809	575,000

FRASER RIVER.

Location.—At Hope in section 16, township 5, range 26, west of 6th meridian.

Records Available.—Continuous records since March 5, 1912.

Winter Conditions.—Open water practically all year.

Gauge.—Gauge painted on rock bluff, graduated to feet, tenths by estimation—Gauge readings daily.

Channel.—Permanent channel, deep water.

Discharge Measurements.—Mainly boat measurements, of only moderate accuracy. One float measurement at high water. Six measurements in all during 1912 and 1913 covering practically all stages

Accuracy.—Fair only. The completion of the Kettle Valley Railroad bridge will permit of better measurement being taken during 1914.

FRASER RIVER.

Fraser river has its source in the Yellowhead pass at an elevation of 3,710 feet, and after flowing some 700 miles in a general southwesterly direction, discharges into the Pacific ocean (strait of Georgia) near New Westminster. Of its length, the lower 175 miles is within the Railway Belt. The important tributaries within the Belt are Pitt river, Stave river, Sumas river, Harrison river, Nahatlatch (or Salmon) river, Silver-Hope creek, Coquihalla river, Stein creek, and Thompson river, the last named being the largest confluent. Outside the Railway Belt there are Bridge, Chilcotin, Quesnel, Blackwater, Nechako, and Willow rivers. Near Fort George the North Fork and South Fork unite. Bear river is a tributary of the South Fork.

The drainage area of the Fraser river is about 90,000 square miles. The report of the water powers of Canada, issued by the Commission of Conservation, 1911, gives it as 91,700 square miles. The said report also gives an interesting article on the Fraser river in the chapter on British Columbia.

The drainage area of the Fraser river above Lytton (i.e., above the mouth of Thompson river) is 63,000 square miles.

The drainage area of the Fraser above the gauging station at Hope (including the Coquihalla river) is 85,600 square miles.

The Fraser is important for fishing, navigation, and lumbering. There are some millions of latent horse-power in the river, particularly in the Fraser river canyon, but it is not likely that the river will be harnessed in the near future. A company now has a project for developing power at Hell's Gate, near Yale, where the river runs through a narrow canyon, and the difference between extreme high water and low water is about 100 feet.

Fraser river is the largest stream lying wholly in British Columbia, and it has played a very important part in the development of the province. It was the discovery of gold in the bed of the Fraser river that brought large numbers of men into the country; and it was the gradual movement of the gold seekers up the valley that opened up the country and led to the building of roads and bridges. When the Canadian Pacific railway was built it followed the Fraser for 150 miles, and the Thompson, a tributary of the Fraser, for as many more. The Canadian Northern Pacific railway follows the Fraser and Thompson to Kamloops, goes up the North Thompson, strikes across the divide to the upper Fraser again, and follows it to the Yellowhead pass. The Grand Trunk Pacific follows the upper Fraser river from the Yellowhead pass for 390 miles or more. Since the railways are the most important factors in developing a country rich in natural resources, the valleys of the Fraser river and its tributaries will necessarily continue to be of great importance.

Probably the most important industry connected with the Fraser river is the fishing. Salmon of various kinds come in from the salt water in countless numbers in the fall and swarm up the Fraser river, heading for the spawning grounds on the smaller rivers and creeks. Great numbers of them are caught near the mouth of the Fraser, and large canneries are situated there; and salmon are caught on all parts of the Fraser and on all the streams that flow into it. In the winter, dried fish is the staple diet of the Fraser River Indians.

British Columbia is essentially a mountainous country, and the watershed of the Fraser follows the general rule. As a result, the amount of land suitable for agriculture is relatively small. It is found mostly in small flats and benches along the Fraser and its tributaries; and sometimes a valley will widen out and give a larger expanse of good land, as in the case of the Nicola valley, where there are several townships of good land in a block. Many of the small flats

contain excellent land, and some of them in the dry belt are well sheltered and make splendid fruit land. Probably the richest land in the whole province is the delta land near the mouth of the Fraser river, of which Lulu island is a good example.

In the days of the gold rush, before the Canadian Pacific railway was built, steamers ran up the Fraser as far as Yale, which is 100 miles from the coast. During the construction of the Canadian Northern, supplies were distributed by steamer as far as Yale. But as a rule navigation on the Fraser is now confined to the 50-mile stretch from Chilliwack to the mouth. This part of the stream is tidal, and river steamers make regular trips between New Westminster and Chilliwack, calling at many points on both sides of the river on the way. But the construction of railways and electric lines is rendering the river transportation less important than formerly.

On the other hand, the importance of the Fraser river as a port for ocean shipping is increasing. In the early days, New Westminster was the only port on the mainland, and there was sufficient water over the bar for the ships of those days. But with the coming of the Canadian Pacific railway to Burrard inlet and the increase in the draught of ocean-going vessels, the Fraser river became of secondary importance. Now, however, jetties are being built at the mouth of the river so that the stream will keep its channel scoured clean, and dredging is being done where necessary. In Burrard inlet, most of the suitable waterfront is in use, and all of it is held at high prices; while along the Fraser river there are miles of good waterfront lying idle. New Westminster is starting on an extensive harbour development programme, and intends to improve the waterfront along the city and to build docks on Annacis island. The Canadian Northern railway is planning a town at Port Mann where for two or more miles there is deep water close to the shore. An industrial city seems to be starting around the Canadian Pacific railway yards at Coquitlam, and harbour surveys are being made along the Fraser and Pitt rivers. It is probable the Fraser will develop into a fresh-water harbour of considerable importance.

Lumbering is one of the chief industries of British Columbia, and there is a good deal of timber in the Fraser river watershed. The best timber is near the coast, where fir and cedar grow to immense sizes, but most of the watershed is covered with timber of some kind. In the dry belt the lower benches are often bare, but there are generally trees on the hills. In the mountains there are trees on the lower hills, though the higher peaks may rise above the timberline. In the Cariboo district, there has been cut only what timber was required for local use. The same is practically true of the dry belt. But at the coast, in addition to supplying the large local demand, a great deal of timber is shipped by rail to the prairie, and by water to Australia, South America, and the Orient. The longest sizes of cedar poles are sent by rail even as far as Ontario. The logs are floated to navigable water, where they are made into rafts and towed to the mills. There are several mills on the Fraser river, and one of them is said to be the largest in the world; but a good deal of timber they use is cut outside the Fraser watershed. Up to the present the timber which has been cut is that in the lower parts of the valleys, where it has been within easy reach of the water. But before long it will be necessary to build logging railroads to the headwaters, and the cutting of the timber there, unless done under careful supervision, with provision for reforestation, will affect the regimen of the streams.

There are no very good power sites on the Fraser river inside the Railway Belt, though many of its tributaries have excellent ones. There are no falls on the river and no very heavy rapids. There are places in the canyon where 30 or 40 feet of head could be obtained by means of a dam. But there is a railroad on each side of the river, not far above the high-water line as it is at present, and it would be found very difficult to take care of the heavy flood discharge in the narrow canyon.

Outside the Railway Belt, there is not much better chance of developing power on the Fraser. Between Lillooet and Soda creek, a distance of some 120 miles, there is a drop of about 800 feet, but there is no very heavy fall at any one point. From Soda creek to Fort George and From Fort George to Tete Jaune Cache the river can be navigated at certain seasons, though there are a few places where power might be developed by means of a dam. The upper stretch was used only during the construction of the Grand Trunk Pacific railway, and now that the railway has been completed the boats will probably not be used much. Between Fort George and Soda Creek, however, boats have been running for a number of years. The completion of the Grand Trunk Pacific railway will probably considerably lessen the traffic, but the route will be used until the completion of the section of the Pacific Great Eastern railway between Lillooet and Fort George. Though the completion of these railways will probably result in the cessation of navigation on the river, the presence of the railways along the banks of the river will be a great hindrance to the development of power in most places. The difficulty of handling the big floods and the necessity of providing proper passes for the salmon and other fish will also prove deterrent factors. British Columbia is so well supplied with good development sites with moderate flows under relatively high heads that it is very doubtful if low head propositions such as the Fraser presents, would be economically feasible.

The Fraser river empties into the gulf of Georgia, and at the mouth it rises and falls with the tides; and this tidal influence extends up the river with diminishing effect until it becomes almost negligible at Agassiz, 70 miles from the mouth. The tide rises several feet in Pitt river and Pitt lake. Hence during ordinary stages of the Fraser, there is quite a current upstream past New Westminster when the tide is rising. This is of importance for navigation, and for water supply and sewage disposal.

At New Westminster the Fraser presents quite an imposing appearance, being more than half a mile in width and, in the main channel, about 40 feet deep. In addition to the ordinary flow of the stream there is the ebb and flow of the tidal water. Near Hope, 90 miles from the mouth, the river varies from 700 to 1,000 feet in width, is 40 feet deep, in places, at low water, and at high water rises 20 feet above the low-water mark. The maximum discharge in 1913 was 450,000, the minimum 13,400, and the mean for the year about 92,000 cubic feet per second. At Yale, 100 miles from the mouth, the canyon begins, and the river is confined between solid rock walls. In many places it is only two or three hundred feet wide, and varies in depth at low water from 20 to 80 feet. During the flood it sometimes rises in certain confined parts of the canyon as much as 100 feet above the low-water mark. This canyon extends for about 30 miles, and is awe-inspring in its rugged grandeur. Above the canyon the banks are still high, but the rock is not so much in evidence. At Lytton, 150 miles from the mouth, the Thompson river enters, and above the mouth of the Thompson, the Fraser is from 300 to 700 feet wide, 15 feet deep at low water and at high water rises 25 feet above the low-water mark. The maximum discharge for 1913, 182,000, the minimum 1,500, and the mean 56,770 cubic feet per second.

The Fraser river is about 700 miles long and has a drainage area of 90,000 square miles. It rises near the summit of the Yellowhead pass, which has an altitude of 3,710 feet above the sea-level. Near Tête Jaune Cache, 50 miles from the summit, the altitude is 2,400 feet. Between that point and Fort George the stream is navigable during high water. The altitude at this later point is 1,900—a descent of 550 feet in about 200 miles. Near Fort George the Fraser river turns south. Steamers make regular trips on the 120-mile stretch between Fort George and Soda creek. At Lillooet, 130 miles farther south, the elevation is 665 feet. Near Lytton, 50 miles from Lillooet, the mean elevation is about 450 feet. Yale is 53 miles below Lytton, and the mean elevation of the water

at the average height is 170 feet. At Hope, 13 miles south of Yale, the Fraser begins to turn in a westerly direction; its elevation is about 125 feet. From Agassiz, 19 miles below Hope the course is almost directly West to the gulf of Georgia. The elevation of the river at Agassiz is about 60 feet. For the last 50 miles from Chilliwack to the mouth of the stream is affected more or less by the tides.

There are at present two gauging stations on the Fraser river. One is at Lytton, just above the mouth of the Thompson river, and is to give the flow of the upper Fraser river. The other was established at Hope, and gives practically the whole flow of the stream. The aim was to have the station as near the mouth as possible and still avoid all tidal influences.

The gauging station at Hope was established on March 1, 1912, and continuous records have been kept ever since. It is below the mouth of the Coquihalla river. The original gauge was painted on the smooth face of the rocky point where the Kettle Valley Railway bridge has been built. A vertical staff gauge has since been attached to the east face of the east pier. These gauges give the same reading and are referred to bench-marks on both sides of the river.

Before the construction of the bridge, it was quite difficult to get good meter measurements at the higher stages. It was not considered advisable to erect an expensive cable station, particularly as the construction of the bridge might render it unnecessary. At the lower stages a boat could be anchored in the stream and its position determined by triangulation from the shore. At higher stages a motor-boat was used for several stages but it was sometimes difficult to get the anchor to hold the boat or the section, even with the help of the engine. An attempt to put in permanent anchors and buoys failed on account of the swift current. Two measurements were made from the ferry cable at Yale, 10 miles farther up the river, but one float measurement was made at Hope. Taken together, the measurements gave a fair curve, but now that the bridge has been built probably better results can be obtained in 1914. It is quite possible that the construction of the bridge piers may have materially affected the rating of the gauge, but that will be determined during 1914, and a new curve constructed if necessary.

The gauging station near Lytton is at the ferry crossing, about 2 miles from the town. The gauge is painted on an irregular rock point. Meter measurements are made from the ferry boat, which is held against the current by the ferry cable and kept in its proper position as nearly as possible by the steering oar. The distance from the shore is measured by triangulation.

In 1914 it is proposed to establish a new station at the Pacific Great Eastern Railway trestle, near Lillooet. This station is to be used in connection with the one on the Thompson river at Spences Bridge for estimating the Fraser river floods.

Discharge Measurements of Fraser River near Hope, 1912–13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge
1912.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft
March 5	C. G. Cline	1,046	690	14,405	1·27	10·0	[1]18,280
June 6	B. Corbould	1,046	1,000	19,835	6·80	21·0	135,704
" 28	C. G. Cline	1,046	710	26,500	8·49	24·5	[2]225,000
Sept. 26	do	1,046	575	12,500	5·90	14·0	73,400
" 24	do	1,046	885	17,200	4·00	14·7	[3]69,947
1913.							
June 21	K. G. Chisholm	1,046	1,016	27,100	10·20	26·0	[4]278,000

Note.—[1] Section at gauge. [2] Measured at Yale. [3] Section above gauge. [4] Float measurement.

Monthly Discharge of Fraser River near Hope for 1912.

(Drainage area, 85,600 square miles.)

Month.	Discharge in Second-Feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
March	19,500	14,200	16,150	0·19	0·22	990,000
April	69,500	19,500	40,720	0·48	0·54	2,420,000
May	217,600	68,000	150,000	1·75	2·02	9,223,000
June	246,000	139,200	186,000	2·17	2·42	11,070,000
July	191,800	114,000	136,000	1·59	1·83	8,362,000
August	123,800	97,000	113,000	1·32	1·52	6,948,000
September	91,000	52,000	70,170	0·80	0·92	4,177,000
October	68,000	44,000	53,000	0·63	0·73	3,308,000
November	45,000	33,000	39,300	0·46	0·51	2,339,000
December	32,000	24,000	27,800	0·32	0·37	1,709,000

Monthly Discharge of Fraser River near Hope for 1913.

(Drainage area, 85,600 square miles.)

Month.	Discharge in Second-Feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	25,000	13,400	17,800	0·21	0·24	1,093,000
February	44,000	18,000	25,300	0·30	0·31	1,401,000
March	24,000	17,400	19,000	0·22	0·26	1,169,000
April	65,500	17,400	34,400	0·40	0·45	2,040,000
May	162,000	34,000	82,300	0·96	1·11	5,053,000
June	450,000	173,000	306,800	3·58	3·99	18,227,000
July	289,400	167,000	201,000	2·35	2·71	12,355,000
August	203,000	153,000	177,000	2·07	2·39	10,910,000
September	160,000	80,000	113,900	1·33	1·48	6,767,000
October	78,000	51,000	60,300	0·70	0·81	3,710,000
November	56,000	29,000	37,200	0·43	0·48	2,210,000
December	.....	.....	27,000	0·32	0·37	[1]1,657,000
The year	450,000	13,400	92,120	1·07	14·60	66,592,000

Note.—Accuracy "C".

[1] Est'd.

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Daily Gauge Heights and Discharges of Fraser River near Hope for 1912.

Day.	March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	16,000	10·2	19,500	14·9	68,000	23·0	184,000
2	.....	16,000	10·7	24,000	15·2	71,500	23·0	184,000
3	.....	16,000	10·5	22,100	16·0	80,000	22·7	177,400
4	.....	16,000	10·7	24,000	16·7	87,500	22·0	182,000
5	.....	16,000	10·7	24,000	17·0	91,000	21·5	153,000
6	10·0	18,000	10·7	24,000	17·3	95,000	21·0	144,000
7	9·7	16,200	10·9	26,000	17·6	98,000	20·8	140,800
8	9·7	16,200	11·0	27,000	18·0	103,000	20·9	142,400
9	9·6	15,700	11·1	28,000	18·5	109,000	20·7	139,200
10	9·6	15,700	11·2	29,000	18·9	113,400	20·7	139,200
11	9·6	15,700	11·2	29,000	19·2	115,800	20·8	140,800
12	9·6	15,700	11·5	32,000	19·7	123,800	21·2	148,000
13	9·6	15,700	11·6	33,000	19·9	126,600	21·7	157,000
14	9·5	15,200	11·7	34,600	19·9	126,600	21·9	160,200
15	9·4	14,700	11·9	36,000	20·1	129,700	22·0	162,000
16	9·5	15,200	12·0	37,000	21·7	157,000	22·8	179,600
17	9·6	15,700	12·7	44,000	21·7	157,000	23·0	184,000
18	9·7	16,200	12·5	42,000	22·0	162,000	23·7	203,000
19	9·7	16,200	12·7	44,000	23·5	197,000	23·5	197,000
20	9·6	15,700	13·0	47,000	23·6	200,000	23·8	206,000
21	9·7	16,200	13·2	49,000	23·7	203,000	24·2	217,600
22	9·6	15,700	13·5	52,000	23·5	197,000	24·9	237,200
23	9·5	15,200	13·8	56,000	22·8	179,600	25·1	243,400
24	9·5	15,200	14·0	58,000	23·2	189,200	25·2	246,800
25	9·3	14,200	14·0	58,000	24·0	212,000	25·2	246,800
26	9·7	16,200	14·1	59,000	24·1	214,800	24·8	234,400
27	9·8	16,800	14·5	63,000	24·2	217,600	24·5	226,000
28	10·1	18,700	14·7	65,500	24·0	212,000	24·5	226,000
29	10·2	19,500	14·8	66,500	24·0	212,000	24·0	212,000
30	10·0	18,000	15·0	69,000	23·7	203,000	23·5	197,000
31	9·9	17,400	.....	.....	23·5	197,000	.....	.....

Daily Gauge Heights and Discharges of Fraser River near Hope, for 1912—*Concluded.*

Day.	July		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	23·3	191,800	18·9	113,400	17·0	91,000	13·3	50,000	12·6	43,000	11·4	31,000
2	23·0	184,000	18·8	112,300	16·7	87,500	13·5	52,000	12·5	42,000	11·5	32,000
3	22·7	177,400	18·8	112,300	16·7	87,500	13·5	52,000	12·4	41,000	11·3	30,000
4	21·3	150,000	18·9	113,400	16·5	85,000	13·2	49,000	12·2	39,000	11·4	31,000
5	21·9	160,200	19·1	115,400	16·0	80,000	13·0	47,000	12·1	38,000	11·5	32,000
6	21·1	146,000	19·1	115,400	15·9	79,000	13·5	52,000	12·0	37,000	11·3	30,000
7	20·9	142,400	19·0	114,000	15·8	78,000	14·0	58,000	12·2	39,000	11·4	31,000
8	20·9	142,400	18·9	113,400	15·7	77,000	14·9	68,000	12·1	38,000	11·2	29,000
9	20·8	140,800	19·0	114,000	15·7	77,000	14·3	61,000	12·2	39,000	11·0	27,000
10	20·8	140,800	19·1	115,400	15·5	75,000	14·2	60,000	12·2	39,000	11·0	27,000
11	20·5	136,000	18·9	113,400	15·7	77,000	14·1	59,000	12·1	38,000	11·1	28,000
12	20·0	128,000	18·9	113,400	15·5	75,000	14·2	60,000	12·0	37,000	11·2	29,000
13	20·2	131,400	19·0	114,000	15·6	76,000	14·2	60,000	12·8	45,000	11·4	31,000
14	20·2	131,400	19·5	121,000	15·2	71,500	14·0	58,000	12·4	41,000	11·4	31,000
15	20·3	133,100	19·5	121,000	14·9	68,500	14·0	58,000	12·2	39,000	11·2	29,000
16	20·8	140,800	19·3	118,200	15·0	69,000	13·8	56,000	12·2	39,000	11·1	28,000
17	20·5	136,000	18·7	112,000	15·0	69,000	14·0	58,000	11·9	36,000	10·9	26,000
18	20·1	129,700	18·5	109,000	15·0	69,000	13·8	56,000	12·1	38,000	10·9	26,000
19	19·9	126,600	18·5	109,000	14·9	68,000	13·7	54,500	12·9	45,000	10·8	25,000
20	19·8	125,800	18·7	111,200	14·8	66,500	13·7	54,500	12·4	41,000	10·7	24,000
21	19·7	123,800	18·7	112,200	14·8	66,500	13·8	56,000	12·2	39,000	10·7	24,000
22	19·6	122,400	18·7	111,200	14·7	65,500	13·5	52,000	12·5	42,000	10·7	24,000
23	19·7	123,800	18·7	111,200	14·5	63,000	13·5	52,000	12·8	45,000	10·8	25,000
24	19·5	121,000	18·9	113,400	14·4	62,000	13·3	50,000	12·7	44,000	10·9	26,000
25	19·7	123,800	19·1	115,400	14·2	60,000	13·3	50,000	12·4	41,000	10·8	25,000
26	19·8	125,200	19·7	123,800	14·0	58,000	13·3	50,000	11·9	36,000	11·0	27,000
27	19·8	125,200	19·7	123,800	14·0	58,000	13·0	47,000	11·8	35,000	10·7	24,000
28	19·5	121,000	19·3	118,200	14·0	58,000	12·8	45,000	11·8	35,000	10·9	26,000
29	19·1	115,400	18·0	103,000	13·8	56,000	13·0	47,000	11·7	34,000	11·0	27,000
30	19·0	114,000	17·9	101,500	13·5	52,000	12·9	46,000	11·6	33,000	11·1	28,000
31	19·1	115,400	17·5	97,000	.....	.....	12·7	44,000	.....	.....	11·2	29,000

SESSIONAL PAPER No. 25f

Daily Gauge Heights and Discharges of Fraser River near Hope for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft	Feet	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	10·7	24,000	10·0	18,000	10·0	18,000	9·9	17,400	12·6	43,000	22·5	173,000
2	10·8	25,000	10·5	22,100	10·1	18,700	9·9	17,400	12·3	40,000	23·8	206,000
3	10·7	24,000	11·1	28,000	10·3	20,300	9·9	17,400	12·1	38,000	24·7	231,600
4	10·8	25,000	11·2	29,000	10·0	18,000	9·9	17,400	12·0	37,000	25·5	257,000
5	10·2	19,500	11·5	32,000	10·2	19,500	10·0	18,000	11·8	35,000	25·0	240,000
6	10·2	19,500	12·7	44,000	10·7	24,000	10·0	18,000	11·7	34,000	24·1	214,800
7	10·2	19,500	12·0	37,000	10·3	20,300	10·0	18,000	11·7	34,000	24·3	220,400
8	10·7	24,000	11·3	30,000	10·3	20,300	10·0	18,000	11·8	35,000	24·7	231,600
9	9·8	16,800	11·0	27,000	10·3	20,300	10·1	18,700	12·0	37,000	24·9	237,200
10	10·0	18,000	10·8	25,000	10·3	20,300	10·1	18,700	12·4	41,000	26·0	274,000
11	9·9	17,400	10·7	24,000	10·2	19,500	10·2	19,500	12·7	44,000	27·4	326,000
12	10·0	18,000	10·6	23,000	10·2	19,500	10·5	22,100	13·2	49,000	28·5	375,000
13	9·1	13,400	10·5	22,100	10·2	19,500	10·5	22,100	14·7	65,500	29·0	400,000
14	9·3	14,200	10·2	19,500	10·2	19,500	10·6	23,000	15·6	76,000	30·2	450,000
15	9·3	14,200	10·4	21,200	10·2	19,500	10·9	26,000	16·0	80,000	30·2	450,000
16	9·5	15,200	10·5	22,100	10·2	19,500	11·2	29,000	16·3	83,000	29·6	430,000
17	9·5	15,200	11·1	28,000	10·2	19,500	12·0	37,000	16·7	87,500	29·1	405,000
18	9·4	14,700	11·1	28,000	10·0	18,000	11·9	36,000	16·7	87,500	28·3	365,000
19	9·4	14,700	10·7	24,000	10·3	20,300	12·6	43,000	16·8	88,500	27·7	338,600
20	9·5	15,200	10·7	24,000	10·3	20,300	13·0	47,000	16·8	88,500	27·2	318,000
21	9·7	16,200	10·5	22,100	10·2	19,500	13·4	51,000	17·0	91,000	26·7	299,200
22	9·7	16,200	10·7	24,000	10·1	18,700	13·7	54,500	17·2	93,500	26·4	289,400
23	10·0	18,000	10·5	22,100	10·0	18,000	14·0	58,000	18·4	107,500	26·7	299,200
24	10·1	18,700	10·7	24,000	19·9	17,400	14·7	65,500	19·2	116,800	27·1	314,000
25	10·2	19,500	10·5	22,100	9·9	17,400	14·6	64,000	19·9	126,600	27·4	326,000
26	9·8	16,800	10·5	22,100	9·9	17,400	14·5	63,000	20·7	139,200	27·2	318,000
27	9·7	16,200	10·5	22,100	9·9	17,400	13·7	54,500	20·7	139,200	27·2	318,000
28	9·7	16,200	10·4	21,200	9·9	17,400	13·0	47,000	20·9	142,400	26·8	303,800
29	9·6	15,700	.....	.	9·9	17,400	12·8	45,000	21·1	151,500	26·7	299,600
30	9·6	15,700	.....	.. ..	9·9	17,400	12·7	44,000	21·8	158,700	26·6	295,600
31	9·5	15,200	.		9·9	17,400	.....	.....	22·0	162,000	.. ..	.....

DAILY GAUGE HEIGHTS AND DISCHARGES of Fraser River near Hope for 1913—*Concluded.*

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	26·4	289,400	22·2	167,000	21·7	157,000	15·9	78,000	13·8	56,000	[1]	27,000
2	26·2	281,200	21·7	157,000	21·3	150,000	15·7	77,000	13·5	53,500	.....	27,000
3	25·8	267,200	21·5	153,000	20·9	142,000	15·5	75,000	13·3	50,000	.....	27,000
4	25·7	263,900	21·5	153,000	21·9	160,000	15·3	72,500	13·1	48,000	.....	27,000
5	25·3	250,200	21·6	155,000	21·2	148,000	15·1	70,000	13·1	48,000	.....	27,000
6	24·9	237,200	21·7	157,000	20·4	135,000	14·0	58,000	13·0	47,000	.....	27,000
7	24·3	220,000	21·8	159,000	29·8	125,000	13·8	56,000	12·0	37,000	.....	27,000
8	24·0	212,000	21·8	159,000	19·5	121,000	13·7	54,500	12·0	37,000	.....	27,000
9	23·7	203,000	21·9	160,000	19·2	117,000	13·5	52,000	12·0	37,000	.....	27,000
10	23·7	203,000	22·9	182,000	18·5	109,000	13·4	51,000	11·9	36,000	.....	27,000
11	24·0	212,000	23·7	203,000	18·2	105,000	13·5	52,000	11·8	35,000	.....	27,000
12	23·7	203,000	23·7	203,000	17·7	99,000	14·0	58,000	11·8	35,000	.....	27,000
13	23·3	192,000	23·4	194,000	17·4	96,000	14·3	61,000	11·8	35,000	.....	27,000
14	23·0	184,000	23·2	189,000	17·7	99,000	14·1	59,000	11·7	34,000	.....	27,000
15	22·8	180,000	23·2	189,000	17·8	100,500	13·8	56,000	11·7	34,000	.....	27,000
16	22·6	175,000	23·0	184,000	17·5	97,000	13·8	56,000	12·5	42,000	.....	27,000
17	22·3	170,000	22·9	182,000	17·7	99,000	14·0	58,000	12·0	37,000	.....	27,000
18	22·3	170,000	23·1	187,000	17·9	101,500	14·2	50,000	11·9	36,000	.....	27,000
19	22·3	170,000	23·1	187,000	18·2	105,000	14·0	58,000	11·9	36,000	.....	27,000
20	22·3	170,000	23·2	189,000	19·3	118,000	13·9	57,000	11·9	36,000	.....	27,000
21	22·4	172,000	23·3	192,000	20·7	139,000	13·8	56,000	11·9	36,000	.....	27,000
22	22·4	172,000	23·4	194,000	20·3	133,000	13·8	56,000	11·5	32,000	.....	27,000
23	22·6	175,000	23·4	194,000	19·0	114,000	13·9	57,000	11·4	31,000	.....	27,000
24	22·8	180,000	23·3	192,000	18·1	104,000	14·0	58,000	11·3	30,000	.....	27,000
25	23·2	189,000	23·1	187,000	17·8	100,500	14·0	58,000	11·3	30,000	.....	27,000
26	23·5	197,000	22·8	180,000	17·5	97,000	14·2	60,000	11·2	29,000	.....	27,000
27	23·2	189,000	22·7	177,000	17·2	93,500	14·8	66,500	11·2	29,000	.....	27,000
28	23·2	189,000	22·5	173,000	16·8	88,500	14·7	65,500	11·2	29,000	.....	27,000
29	23·0	184,000	22·3	170,000	16·4	84,000	14·2	60,000	11·3	30,000	.....	27,000
30	22·5	173,000	22·2	167,000	16·0	80,000	13·9	57,000	.....	30,000	.....	27,000
31	22·2	167,000	22·1	164,000	.....	.....	13·9	57,000	.....	.....	.....	27,000

[1] Estimated.

GOLD CREEK.

Location.—Near the mouth of creek in section 36, township 39, west of Coast meridian.

Records Available.—Weir measurements two or three times a week beginning July 26, 1910. Regular gauge readings from October 26, 1912, to November 30, 1913.

Winter Conditions.—Open water all year.

Gauge.—Staff gauge nailed to tree. Gauge readings daily.

Channel.—Rocky and steep, water swift at higher stages.

Discharge Measurements.—One meter measurement in 1912 and three in 1913; do not agree very well.

Accuracy.—Only fairly accurate.

GOLD CREEK.

Gold creek rises in the mountains east of lake Coquitlam at an elevation of 2,000 feet or more, and discharges into Coquitlam river below Coquitlam lake at an elevation of about 400 feet. It is part of the Fraser drainage.

The mean annual precipitation in the Gold creek watershed is probably 140 inches or more. In the winter there is a snowfall of something like 6 feet. This probably increases in the higher altitudes. Near the mouth it is not very cold, and open water conditions obtain at the gauging station. In the higher altitudes the winters are more severe.

Float measurements were taken three or four times a week by Mr. R. S. Stronach during his inspection of the construction work at lake Coquitlam. These records are continuous from July 26, 1910, to October 20, 1912. On October 26, a regular gauging station was established . The records were kept until November 30, 1913. All these measurements were taken near the mouth of the creek. The purpose is to show, if possible, that there is sufficient flow in Gold creek to satisfy all the ordinary demands of the riparian owners on the Coquitlam river below the dam. If this is found to be the case, there will be no necessity for the Vancouver Power Company to allow any water to pass through the dam at lake Coquitlam, and the total flow can be stored for use in the power plant.

DISCHARGE MEASUREMENTS of Gold Creek at 1 mile from Mouth, for 1912–13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Oct. 26.....	C. G. Cline.....	1,046	34	47	2·6	3·70	124·0
1913.							
June 11.....	C. G. Cline.....	1,044	28	42	2·5	3·52	107·0
July 18.....	K. G. Chisholm.....	1,055	32	47	2·6	3·45	119·0
Oct. 17.....	H. J. E. Keys.....	1,057	35	26	2·0	3·10	53·7

MONTHLY DISCHARGE of Gold Creek at 1 mile from mouth for 1913.

Month.	Discharge in Second-Feet.			Run-off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
January.....	96	4	48·8	3,000
February.....	390	18	62·1	3,450
March.....	215	18	57·7	3,550
April.....	142	25	91·5	5,450
May.....	245	33	130·0	8,009
June.....	170	96	123·2	7,320
July.....	163	33	84·3	5,180
August.....	142	9	24·1	1,480
September.....	200	8	40·5	2,410
October.....	500	9	63·5	3,900
November.....	530	21	117·9	7,020

NOTE.—Accuracy "C" and "D".

Daily Gauge Heights and Discharges of Gold Creek for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	3·45	96	2·85	29	2·70	18	2·90	33	3·10	54	3·85	149
2	3·40	90	2·83	27	2·70	18	2·80	25	3·05	48	4·00	170
3	3·38	88	2·82	26	2·80	25	2·90	33	3·05	48	3·95	163
4	3·35	84	2·80	25	2·90	33	3·00	42	3·00	42	3·75	135
5	3·00	42	2·79	24	3·10	54	3·10	54	2·90	33	3·55	108
6	2·50	9	2·78	23	3·20	66	3·20	66	3·15	60	3·60	115
7	2·48	8	2·76	22	3·30	78	3·20	66	3·35	84	3·75	135
8	2·30	5	2·74	21	3·35	84	3·30	78	3·75	135	3·80	142
9	2·29	5	2·74	21	3·30	78	3·35	84	3·90	156	3·60	115
10	2·27	4	2·74	21	3·25	72	3·50	102	4·20	200	3·60	115
11	2·27	4	2·73	20	3·20	66	3·65	121	4·50	245	3·52	105
12	2·25	4	2·73	20	3·10	54	3·80	142	4·20	200	3·55	108
13	2·25	4	2·73	20	3·00	42	3·70	128	3·90	156	3·50	102
14	2·35	5	2·95	37	2·95	37	3·65	121	3·80	142	3·55	108
15	2·50	9	3·44	95	2·90	33	3·50	102	3·75	135	3·60	115
16	2·75	21	5·50	390	3·60	115	3·40	90	3·70	128	3·60	115
17	3·10	54	5·30	360	4·30	215	3·40	90	3·50	102	3·45	96
18	3·35	84	3·60	115	3·50	102	3·45	96	3·60	115	3·50	102
19	3·33	82	3·40	90	3·49	90	3·55	108	3·80	128	3·80	142
20	3·32	81	3·30	78	3·30	78	3·60	115	3·60	115	3·85	149
21	3·32	81	3·10	54	3·00	42	4·00	170	3·50	102	3·85	149
22	3·30	78	3·00	42	2·90	33	3·60	115	3·60	115	3·75	135
23	3·29	77	2·90	33	2·80	25	3·40	90	3·70	128	3·60	115
24	3·29	77	2·90	33	2·80	25	3·30	78	3·80	142	3·55	108
25	3·29	77	2·90	33	2·70	18	3·75	135	3·95	163	3·50	102
26	3·30	78	2·90	33	2·70	18	3·90	156	4·20	200	3·50	102
27	3·25	72	2·85	29	2·75	21	3·50	102	4·40	230	3·65	108
28	3·20	66	2·70	18	2·90	33	3·35	84	4·15	192	3·60	115
29	3·10	54	.....	.....	.....	108	3·20	66	3·90	156	3·50	102
30	3·00	42	.....	.....	3·10	54	3·10	54	3·80	142	4·00	170
31	2·90	33	.....	.....	3·00	42	.....	.....	3·70	128	.....	.....

DAILY GAUGE HEIGHTS AND DISCHARGES of Gold Creek for 1913—*Con.*

Day.	July.		August.		September.		October.		November.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height	Discharge.	Gauge Height.	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	3·80	142	2·90	33	2·48	8	2·60	13	2·95	37
2	3·60	115	2·85	29	2·48	8	2·55	11	2·80	25
3	3·50	102	2·80	25	4·10	185	2·55	11	2·75	21
4	3·50	102	2·78	26	4·20	200	2·55	11	2·95	37
5	3·45	96	2·72	20	3·70	128	2·50	9	3·80	142
6	3·45	96	2·67	17	3·30	78	2·45	7	3·70	128
7	3·45	96	2·64	15	3·10	54	2·80	25	3·30	78
8	3·50	102	2·62	14	3·20	66	2·80	25	3·45	98
9	3·65	122	2·60	13	3·15	60	2·70	18	3·60	115
10	3·95	163	2·57	12	3·05	48	3·10	54	3·50	102
11	3·75	135	2·55	11	2·90	33	4·60	260	3·35	84
12	3·40	90	2·82	27	2·80	25	4·30	500	3·05	48
13	3·35	84	2·61	13	2·75	21	4·00	170	2·95	37
14	3·30	78	3·20	66	2·70	18	3·40	90	2·90	33
15	3·25	72	2·90	33	2·65	15	3·50	102	3·00	42
16	3·25	72	2·68	17	2·75	22	3·30	78	5·00	345
17	3·25	72	2·80	25	2·70	18	3·10	54	3·50	102
18	3·30	78	3·80	142	2·65	15	3·10	54	3·40	90
19	3·45	96	3·15	60	2·60	13	3·20	66	3·60	115
20	3·45	96	2·85	29	2·55	11	3·10	54	3·40	90
21	3·45	96	2·60	13	2·70	18	3·05	48	3·10	54
22	3·40	90	2·58	12	2·65	15	2·95	38	3·10	54
23	3·30	78	2·64	15	2·60	13	3·00	42	3·10	54
24	3·20	66	2·60	13	2·60	13	3·20	66	6·50	530
25	3·10	54	2·55	11	2·55	11	2·95	37	5·50	390
26	3·05	48	2·50	9	2·52	10	2·85	29	3·90	156
27	3·00	42	2·55	11	2·55	11	2·80	25	4·00	170
28	2·95	37	2·53	10	3·10	54	2·75	22	3·70	128
29	2·90	33	2·51	9	2·85	29	2·80	18	4·00	170
30	2·90	33	2·50	9	2·65	15	2·65	15	3·50	102
31	2·90	33	2·49	9	.....	....	2·70	18	.....	.....

HIXON CREEK NEAR MOUTH.

Location—Section 34, township 6, range 7, west of 7th meridian.

Records Available.—Continuous records since November, 1912.

Winter Conditions.—Open water all year.

Gauge.—Vertical staff gauge-readings generally four or five a week. Bed of stream scoured out about November 13, 1912, changing rating of gauge. Gauge was finally washed out and new one installed at a different section, September 24, 1913.

Channel.—Rocky, water swift at higher stages.

Discharge Measurements.—One in 1912 for gauge No. 1A; eight in 1913 for gauge No. 1; four in 1913 for gauge No. 2.

Accuracy.—Only moderate accuracy on account of changes. Gauge No. 2 should give accurate results when more fully rated.

HIXON CREEK.

Hixon creek has its source in the mountains northeast of Burrard inlet, at an elevation of about 3,000 feet, and discharges into the Mesliloet river at about 5 miles from the mouth, at an elevation of some 200 feet. It is part of Burrard inlet drainage. The more important tributaries are Belknap creek and Barnes creek, both entering from the north.

The rainfall in the Hixon creek watershed is quite heavy, being probably from 120 to 150 inches. In the winter there is from 2 to 6 feet of snow. In the higher altitudes there are snowfields which remain most of the year. At the mouth of the river the stream is open all the year round, and above Belknap lake there is very little ice, so that open-water conditions exist there too.

The Westminster Power Company may use some of the water from Hixon creek in connection with their high-head development. The latest plan includes the diversion of water from Belknap creek, which is a tributary of Hixon creek, and its storage in Norton lake. It may be possible also to convey water from the main branch of Hixon creek above Belknap creek into the same reservoir. From Norton lake the main pipe-line would lead to the power-house situated near the mouth of Brandt creek. An alternative scheme would provide for a pipe-line down Hixon creek, collecting water from Hixon creek and Belknap lake. This pipe-line, however, would be at a lower elevation than Norton lake, and could not be connected directly to the main penstocks.

Gauging stations have been established at the mouth of Hixon creek and at Hixon creek above Belknap creek. It was hoped that the station at the mouth of the stream might be used to give some idea of the flow higher up the stream, but this has been found impracticable, and the lower station will probably be abandoned as soon as facilities are provided for taking more frequent gauge readings on the upper stations. There are two stations also on Belknap creek, which is a tributary of Hixon creek.

DISCHARGE MEASUREMENTS of Hixon Creek near Mouth, 1912 and 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Oct. 19.....	C. G. Cline.....	1,046	18	35·0	2·04	2·00	[1]71·5
1913.							
June 1.....	H. C. Hughes.....	1,673	36	63·0	5·37	1·80	[2]339·0
" 5.....	do	1,673	36	52·1	4·67	1·48	244·0
" 7.....	do	1,673	36	56·1	4·80	1·60	270·0
" 14.....	do	1,673	35	45·1	4·35	1·30	196·5
" 18.....	do	1,673	34	40·8	4·32	1·25	176·5
" 27.....	do	1,673	34	46·5	4·55	1·40	212·0
July 18.....	do	1,673	28	26·6	5·63	1·02	[3]150·0
Aug. 4.....	do	1,673	28	23·0	4·52	0·69	104·0
Sept. 24.....	F. MacLachlan.....	1,673	48	27·4	1·21	3·79	[4]33·2
Oct. 18.....	do	1,673	54	44·5	1·64	4·34	72·5
" 31.....	do	1,673	51	31·5	1·15	3·89	36·3
Nov. 5.....	do	1,521	56	53·4	2·27	4·59	121·0

NOTE.—[1]Gauge No. 1A.
[2] Gauge No. 2.
[3] Different Section.
[4] Different Gauge No 2.

Monthly Discharge of Hixon Creek near Mouth for 1913.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum	Minimum.	Mean.	Total in acre-feet.
January	70	53	66·8	4,100
February	121	20	52·7	2,920
March	82	53	66·9	4,110
April	166	59	104·6	6,200
May	675	75	246·3	15,100
June	525	175	273·5	16,300
July	344	95	178·0	10,900
August	142	70	90·2	5,550
September	167	34	59·8	3,560
October	661	31	104·0	6,400
November	702	40	166·5	9,880
December	200	37	84·6	5,200
The year	702	20	124·5	90,200

Note.—Accuracy "A" and "C".

Monthy Discharge of Hixon Creek near Mouth for 1912.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
November	570	66	149	8,870
December	110	60	69	4,240

Note.—Accuracy "A" and "C".

Daily Gauge Heights and Discharges of Hixon Creek near Mouth for 1912.

Day.	October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	1·7	66	.....	74
2	.....	.....	1·9	70	0·25	74
3	.....	.....	2·15	75	.....	70
4	.....	.....	.....	100	0·1	67
5	.....	.....	2·85	124	.....	62
6	.....	.....	.....	108	−0·25	57
7	.....	.....	2·55	92	.....	60
8	.....	.....	.....	100	−0·03	63
9	.....	.....	.....	106	.....	66
10	.....	.....	.....	114	.....	70
11	.....	.....	.....	122	.....	73
12	.....	.....	2·9	130	0·3	76
13	.....	.....	Gauge No. 1	180	0·25	74
14	.....	.....	1·45	231	0·75	110
15	.....	.....	1·25	185	.....	92
16	.....	.....	1·05	150	0·25	74
17	Gauge	.....	.....	150	0·1	67
18	No. 1A	.....	.....	150	0·5	87
19	2·0	72	.....	150	0·2	71
20	.....	70	1·05	150	0·05	56
21	1·85	69	2·35	570	.....	64
22	.....	72	.....	430	−0·03	63
23	.....	75	.....	290	.....	63
24	.....	78	1·05	150	.....	63
25	.....	81	0·6	95	.....	63
26	.....	85	.....	85	−0·03	63
27	2·5	88	0·3	76	0·2	71
28	.....	84	0·2	71	0·05	66
29	.....	80	.....	72	.....	64
30	.....	75	.....	73	.....	62
31	.....	70	.....	.....	.....	60

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Daily Gauge Heights and Discharges of Hixon Creek near Mouth for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	0·0	70		64		53	−0·35	61	0·3	79	1·8	344
2		70		58		56	−0·4	59		77	2·0	420
3	0·0	70		52		59	−0·1	68	0·2	76		380
4		70		46		62		72		76		320
5		69		40	−0·2	65	0·2	76	0·15	75	1·5	245
6		68		34		69		73		101		260
7		67	−1·4	27		73	0·0	70	0·9	127	1·6	275
8		66		25	0·2	76		78	1·5	186		250
9	−0·2	65		24		74		86	1·5	245	1·45	232
10		66		22	0·1	73	0·6	95		255		236
11		68	−1·6	20		73	1·05	150		265		240
12	0·0	70		20	0·1	73	1·15	166	1·6	275	1·5	245
13		70		20	−0·1	68		151		265	1·55	260
14		70		20		71		136		255	1·3	194
15	0·0	70		45		74	0·85	121	1·5	245		234
16		70		70		77		108	0·9	127	1·6	275
17		70		95		80	0·6	95	0·9	127	1·2	175
18		70	0·85	121	0·35	82	1·0	142	0·95	134	1·25	185
19		70		100		72		142		154		250
20		70	0·35	82	−0·3	62	1·0	142	1·2	175	1·7	308
21		70		77		62		129	1·15	166	2·25	525
22	0·0	70	0·1	73		61	0·8	116	1·3	194		400
23		65		66	−0·35	61		102	1·5	245	1·6	275
24		60	−0·4	59	−0·5	56	0·5	88	1·5	245		265
25		56		57	−0·5	56	0·55	92		420		255
26	−0·6	53		55		59		99	2·45	610	1·5	245
27		57	−0·6	53		62		108	2·6	675	1·4	218
28		60	−0·7	50		65	0·8	116		575		218
29		64			−0·1	68		104		470	1·4	218
30		67				66		92	1·85	362		208
31	0·0	70				64				354		

DAILY GAUGE HEIGHTS AND DISCHARGES of Hixon Creek near Mouth for 1913.—*Con.*

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	197	0·65	100	0·00	70	.....	64	.....	40	4·45	93
2	.....	186	0·67	102	0·05	72	.....	53	4·0	44	4·35	77
3	1·2	175	.....	103	.....	72	.....	42	.....	70	4·25	64
4	1·25	185	0·69	104	Gauge	771	3·7	32	.....	95	.....	64
5	1·3	194	0·6	95	washed out	70	3·65	31	4·59	121	.....	64
6	.....	270	0·55	92	.....	69	3·65	31	4·55	113	4·25	64
7	1·8	344	0·5	88	.....	68	3·7	32	4·3	70	4·45	83
8	1·3	194	0·5	88	.....	67	.....	32	.....	75	4·23	62
9	.....	245	0·45	86	.....	66	3·7	32	.....	80	4·2	58
10	1·6	275	.....	85	.....	65	.....	200	.....	85	.....	120
11	1·3	194	0·4	84	.....	63	5·25	354	4·45	93	4·8	182
12	1·2	175	0·45	86	.....	61	6·00	661	.....	73	.....	155
13	.....	150	0·5	88	.....	59	5·25	354	4·15	54	4·6	124
14	0·85	121	0·55	92	.....	56	4·8	182	.....	66	.....	165
15	0·8	116	.....	104	.....	54	.....	150	.....	78	4·85	200
16	.....	121	.....	116	.....	51	.....	115	.....	90	4·6	124
17	0·9	127	.....	130	.....	48	4·4	84	4·5	102	.....	104
18	1·02	150	1·0	142	.....	46	4·34	73	4·4	84	4·4	184
19	1·3	194	0·6	95	.....	44	4·35	77	.....	93	.....	60
20	.....	200	0·5	88	.....	42	.....	69	4·5	102	4·1	55
21	.....	206	0·3	79	.....	40	.....	61	4·15	54	4·0	44
22	.....	212	0·3	79	Gauge	38	4·15	54	.....	74	.....	44
23	1·4	218	0·35	79	No. 2	36	.....	59	4·45	93	4·0	44
24	1·3	194	0·25	78	3·78	34	4·25	64	.....	400	3·85	37
25	1·2	175	0·2	76	.....	35	.....	59	6·1	702	.....	37
26	.....	155	0·2	76	.....	35	.....	54	.....	550	3·85	37
27	.....	135	.....	74	3·85	37	.....	49	5·4	415	.....	47
28	0·8	116	0·1	73	4·75	167	.....	43	.....	415	4·2	58
29	0·65	100	0·05	72	4·4	84	3·85	37	5·4	415	4·1	50
30	.....	98	.....	71	.....	74	3·75	32	.....	250	.....	90
31	0·6	95	0·0	70	.....	.....	3·89	36	.....	.....	4·6	124

JONES CREEK.

Location.—At outlet of Jones lake in section 28, township 3, range 27, west of the 6th meridian.

Records Available.—Continuous records since April, 1911, supplied by Messrs. Anderson and Warden, Vancouver. Records in this report continuous since November 1, 1911.

Winter Conditions.—Open water.

Gauge.—Vertical staff, gauge readings made daily by men specially employed by Messrs. Anderson and Warden, Civil Engineers.

Channel.—Uniform section with deep water and a good control.

Discharge Measurements.—One measurement in 1911, one in 1912, and two in 1913 are well distributed and agree fairly well with those taken by Messrs. Anderson and Warden.

Accuracy.—Good measurements and gauge readings.

JONES LAKE AND CREEK.

Jones creek rises in Jones lake, which is situated in the north-westerly part of township 3, range 27, west of the 6th meridian, and which is at an elevation of 1,950 feet. It is marked Wahleach creek on some of the Dominion sectional Maps. The creek discharges into Fraser river near Ruby creek in section 19, township 4, range 27, at an elevation of about 100 feet. It is part

of the Fraser drainage. Boulder creek enters from the east just below Jones lake. The area of the watershed above the outlet of the lake is 40 square miles. The water is not used at present, but it is proposed to use it for the development of power. Careful hydrographic studies have been made at Jones lake during 1911, 1912, and 1913 by Anderson and Warden, Civil Engineers, Vancouver, acting for the Vancouver Power Company. They established a gauging station on Jones creek at the outlet from Jones lake, and another on Boulder creek near the mouth, and regular gauge readings have been taken since March 24, 1910. The precipitation is from 80 to 90 inches per annum.

Jones lake is situated in a valley high up in a spur of the Cheam mountains, east and north of the town of Chilliwack and about 7 miles east of Agassiz. The waters flow in a northerly direction for about 6 miles, discharging into the Fraser river. The drainage area of 40 square miles lies mostly above the 3,000-foot level, and some of the surrounding mountains are 8,000 feet high. The land near the lake is covered with an inferior growth of timber, mostly spruce and cedar. The ravines and gullies have a thick growth of fern and devil club.

The area of Jones lake is 1,263 acres. The shores of the lake in places rise abruptly from the water, but in other places, especially where small creeks enter, there are to be found low flats and swamps. At the 50-foot contour the area of the lake or reservoir would be about 2,300 acres.

The construction of a 6-mile pipe-line down the Jones creek valley to the Fraser would be very expensive, and the maintenance of such a construction would be difficult. The development proposed by the Vancouver Power Company is by means of a tunnel from the lake at its most westerly point, extending through the mountains to the Fraser valley. This tunnel would be 10,200 feet long, and from its outlet to the power-house the water would be conveyed in pressure pipes 6,000 feet long. In this way an effective head of 1,800 feet would be obtained.

DISCHARGE MEASUREMENTS of Jones Creek and Jones lake, 1911, 12, 13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Nov. 3	K. H. Smith	1,057	51	96	0·5	0·55	518
1912.							
Sept. 18	C. G. Cline	1,046	51	104	0·8	0·9	87
1913.							
July 24	K. G. Chisholm	1,055	51	180	2·3	2·11	411
Sept. 11	K. G. C. & F. MacL	1,055	51	131	1·3	1·29	175

Monthly Discharge of Jones creek and Jones lake for 1911.

(Drainage area, 40 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
November	395	50	140	3·50	3·90	8,330
December	180	68	110	2·75	3·17	6,760

Monthly Discharge of Jones Creek at Jones lake for 1912.

(Drainage area, 40 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	205	55	84·9	2·12	2·44	5,220
February	190	80	139·4	3·48	3·62	7,720
March	74	49	56·1	1·40	1·61	3,450
April	70	55	62·7	1·57	1·75	3,730
May	320	70	195·7	4·87	5·64	12,000
June	380	170	277·0	6·92	7·72	16,500
July	245	155	211·0	5·28	6·09	13,000
August	320	120	178·7	4·46	5·14	10,900
September	130	60	90·6	2·27	2·53	5,390
October	120	55	79·6	1·99	2·29	4,900
November	320	70	155·6	3·89	4·34	9,230
December	180	70	95·6	2·39	2·75	5,880
The year	380	55	135·3	3·38	45·92	97,920

Monthly Discharge of Jones Creek at Jones lake for 1913.

(Drainage area, 40 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	80	52	59·4	1·49	1·72	3,650
February	260	49	89·5	2·24	2·33	4,970
March	80	55	66·9	1·67	1·92	4,110
April	180	52	94·8	2·37	2·64	5,640
May	395	89	242·0	6·05	6·98	14,880
June	520	320	397·8	9·94	11·08	23,680
July	425	275	350·0	8·75	10·09	21,520
August	290	145	203·9	5·10	5·88	12,500
September	485	98	179·4	4·48	5·00	10,650
October	610	74	199·0	4·98	5·74	12,200
November	320	98	170·6	4·26	4·75	10,100
December	180	55	84·6	2·11	2·43	5,200
The year	610	49	178·2	4·45	60·57	129,100

Note —Accuracy "A".

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Daily Gauge Heights and Discharges of Jones Creek at Jones lake for 1911.

Day.	November.		December.	
	Gauge Height.	Discharge	Gauge Height.	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	50	1·15	142
2	.....	50	1·10	130
3	0·55	52	1·05	119
4	0·60	55	1·05	119
5	0·65	59	1·00	108
6	0·65	59	1·00	108
7	0·75	68	1·00	108
8	0·95	98	1·15	142
9	0·90	89	1·25	167
10	0·80	74	1·30	180
11	0·70	63	1·30	180
12	0·70	63	1·20	155
13	0·75	68	1·10	130
14	0·75	68	1·00	108
15	0·75	68	1·00	108
16	0·75	68	0·95	98
17	1·00	108	0·90	89
18	1·70	290	0·85	82
19	2·05	395	0·85	82
20	1·90	350	0·85	82
21	1·75	308	0·85	82
22	1·55	245	0·90	89
23	1·45	217	1·05	119
24	1·30	180	1·00	108
25	1·35	192	0·95	98
26	1·45	217	0·90	89
27	1·35	192	0·90	89
28	1·30	180	0·85	82
29	1·20	155	0·80	74
30	1·15	142	0·80	74
31	.....	.....	0·75	68

Daily Gauge Heights and Discharges of Jones Creek at Jones Lake for 1912.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	0·70	63	1·25	170	0·80	74	0·60	55	0·80	74	1·35	190
2	0·70	63	1·20	155	0·75	70	0·60	55	0·80	74	1·30	180
3	0·65	60	1·10	130	0·75	70	0·65	60	0·80	74	1·25	170
4	0·65	60	1·05	120	0·70	63	0·65	60	0·80	74	1·25	170
5	0·65	60	1·05	120	0·70	63	0·65	60	0·80	74	1·25	170
6	0·65	60	1·05	120	0·65	60	0·65	60	0·75	70	1·30	180
7	0·60	55	1·05	120	0·65	60	0·65	60	0·85	80	1·45	215
8	0·60	55	1·10	130	0·65	60	0·65	60	1·00	108	1·65	275
9	0·60	55	1·15	140	0·65	60	0·65	60	1·20	155	1·65	275
10	0·60	55	1·30	180	0·60	55	0·70	63	1·20	155	1·65	275
11	0·60	55	1·25	170	0·60	55	0·75	70	1·20	155	1·60	260
12	0·60	55	1·20	155	0·60	55	0·75	70	1·25	170	1·65	275
13	0·70	63	1·15	140	0·55	52	0·75	70	1·40	205	1·80	320
14	0·80	74	1·25	170	0·55	52	0·70	63	1·60	260	1·90	350
15	0·90	89	1·20	155	0·55	52	0·70	63	1·80	320	1·85	335
16	1·00	108	1·25	170	0·55	52	0·70	63	1·70	290	1·70	290
17	0·95	98	1·30	180	0·55	52	0·70	63	1·55	245	1·60	260
18	0·90	84	1·35	190	0·55	52	0·70	63	1·45	215	1·65	275
19	0·85	80	1·30	180	0·55	52	0·70	63	1·40	205	1·75	305
20	0·75	70	1·20	155	0·55	52	0·70	63	1·50	230	1·85	335
21	0·80	74	1·10	130	0·55	52	0·70	63	1·70	290	2·00	380
22	0·80	74	11·10	130	0·50	49	0·70	63	1·70	290	1·90	350
23	0·80	74	1·05	120	0·50	49	0·70	63	1·60	260	1·80	320
24	0·80	74	1·00	108	0·50	49	0·70	63	1·50	230	1·80	320
25	1·00	108	0·95	98	0·50	49	0·70	63	1·50	230	1·85	335
26	1·05	120	0·95	88	0·55	52	0·70	63	1·60	260	1·90	350
27	1·05	120	0·90	89	0·55	52	0·70	63	1·70	290	1·90	350
28	1·00	108	0·85	80	0·55	52	0·70	63	1·65	275	1·80	320
29	1·05	120	.....	.....	0·60	55	0·70	63	1·60	260	1·60	260
30	1·40	205	.....	.....	0·65	60	0·75	70	1·50	230	1·45	220
31	1·35	190	.....	.....	0·65	60	.....	.....	1·40	205	.....	.....

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Daily Gauge Heights and Discharges of Jones Creek at Jones Lake for 1912—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·35	195	1·25	170	1·10	130	0·70	63	0·80	74	1·05	120
2	1·45	220	1·25	170	1·10	130	0·70	63	0·75	70	1·05	120
3	1·40	205	1·20	155	1·10	130	0·80	74	0·75	70	1·30	180
4	1·40	205	1·15	145	1·05	120	0·80	74	0·75	70	1·30	180
5	1·40	205	1·15	145	1·00	108	0·80	74	0·75	70	1·20	155
6	1·50	230	1·10	130	0·95	99	0·75	70	0·75	70	1·10	130
7	1·50	230	1·05	120	1·00	108	0·75	70	0·80	74	1·00	108
8	1·45	220	1·10	130	1·05	120	0·80	74	0·80	74	0·95	98
9	1·40	205	1·25	170	1·05	120	0·80	74	0·80	74	0·95	98
10	1·35	195	1·55	245	1·00	108	0·75	70	0·80	74	0·90	89
11	1·35	195	1·80	320	1·00	108	9·70	63	0·80	74	0·85	80
12	1·35	195	1·60	260	1·00	108	0·70	63	0·85	80	0·90	89
13	1·55	245	1·45	220	1·00	108	0·65	60	0·40	205	0·85	80
14	1·55	245	1·35	195	1·00	108	0·65	60	1·40	205	0·90	89
15	1·55	245	1·40	205	0·95	99	0·60	55	1·30	180	0·90	89
16	1·50	230	1·55	245	0·99	89	0·70	63	1·15	145	0·85	80
17	1·50	230	1·50	230	0·90	89	1·05	120	1·10	130	0·95	98
18	1·50	230	1·45	220	0·90	89	1·00	108	1·40	205	0·95	98
19	1·50	230	1·40	205	0·85	80	1·00	108	1·80	320	0·95	98
20	1·50	230	1·35	195	0·80	74	0·95	98	1·75	305	0·85	80
21	1·45	220	1·30	180	0·80	74	0·90	89	1·75	305	0·80	74
22	1·45	220	1·30	180	0·80	74	0·85	80	1·65	275	0·80	74
23	1·40	205	1·30	180	0·80	74	0·85	80	1·65	275	0·80	74
24	1·40	205	1·30	180	0·80	74	0·85	80	1·55	245	0·80	74
25	1·40	205	1·30	180	0·75	70	0·95	98	1·45	220	0·80	74
26	1·45	220	1·25	170	0·75	70	1·00	108	1·35	195	0·75	70
27	1·40	205	1·20	155	0·70	63	0·95	98	1·25	170	0·75	70
28	1·30	180	1·10	130	0·70	63	0·90	89	1·20	155	0·75	70
29	1·25	170	1·05	120	0·65	60	0·90	89	1·10	130	0·75	70
30	1·20	155	1·05	120	0·65	60	0·85	80	1·10	130	0·80	74
31	1·20	155	1·05	120	.....	.....	0·80	74	.....	.....	0·85	80

Daily Gauge Heights and Discharges of Jones Creek at Jones Lake for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	0·85	80	0·60	55	0·75	70	0·60	55	1·00	108	2·05	395
2	0·80	74	0·60	55	0·75	70	0·60	55	0·95	98	2·30	470
3	0·75	70	0·55	53	0·75	70	0·60	55	0·95	98	2·45	520
4	0·75	70	0·55	53	0·75	70	0·55	52	0·90	89	2·45	520
5	0·75	70	0·50	49	0·75	70	0·55	52	0·90	89	2·30	470
6	0·75	70	0·50	49	0·75	70	0·55	52	0·90	89	2·10	410
7	0·75	70	0·50	49	0·75	70	0·55	52	0·95	98	2·10	410
8	0·75	70	0·50	49	0·75	70	0·55	52	1·10	130	2·20	440
9	0·70	63	0·50	49	0·75	70	0·55	52	1·35	192	2·10	410
10	0·65	60	0·50	49	0·75	70	0·55	52	1·50	230	2·00	380
11	0·65	60	0·50	49	0·70	63	0·55	52	1·60	260	1·95	365
12	0·60	55	0·50	49	0·80	74	0·65	59	1·60	260	1·90	350
13	0·60	55	0·50	49	0·75	70	0·80	74	1·65	275	2·10	410
14	0·60	55	0·50	49	0·70	63	0·90	89	1·65	275	2·15	425
15	0·55	52	0·70	63	0·70	63	0·90	89	1·65	275	2·05	395
16	0·55	52	1·15	142	0·70	63	0·90	89	1·65	275	2·00	380
17	0·55	52	1·60	260	0·85	80	0·90	89	1·60	260	1·85	335
18	0·55	52	1·50	230	0·85	80	0·95	98	1·50	230	1·80	320
19	0·55	52	1·35	192	0·85	80	1·05	119	1·50	230	1·85	335
20	0·55	52	1·20	155	0·80	74	1·15	142	1·50	230	2·30	470
21	0·55	52	1·10	130	0·75	70	1·30	180	1·50	230	2·20	440
22	0·55	52	1·00	108	0·75	70	1·30	180	1·55	245	2·10	410
23	0·55	52	1·00	108	0·70	63	1·20	155	1·75	305	2·00	380
24	0·55	52	0·95	98	0·65	60	1·15	142	1·90	350	1·95	365
25	0·60	55	0·90	89	0·65	60	1·10	130	1·95	365	1·95	365
26	0·70	63	0·85	81	0·60	55	1·05	119	2·05	395	1·90	350
27	0·65	60	0·80	74	0·60	55	1·10	130	2·05	395	1·90	350
28	0·65	60	0·75	70	0·60	55	1·10	130	2·05	395	1·90	350
29	0·60	55	.....	.....	0·60	55	1·10	130	1·90	350	1·90	350
30	0·60	55	.....	.....	0·65	60	1·05	119	1·85	335	1·95	364
31	0·60	55	.....	.....	0·65	60	.....	.....	1·90	350	.....	.....

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DAILY GAUGE HEIGHTS AND DISCHARGES of Jones Creek at Jones Lake for 1913—*Concluded.*

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·00	380	1·70	290	1·15	145	0·95	98	1·05	120	1·30	180
2	1·95	365	1·70	290	1·10	130	0·90	89	1·05	120	1·20	155
3	1·85	335	1·70	290	1·10	130	0·90	89	0·95	98	1·10	130
4	1·75	305	1·65	275	2·05	395	0·85	80	1·05	120	1·05	120
5	1·85	335	1·65	275	2·35	485	0·80	74	1·05	120	1·00	108
6	1·90	350	1·60	260	2·20	440	0·80	74	1·15	140	1·00	108
7	2·10	410	1·55	245	1·80	320	0·80	74	1·10	130	1·00	108
8	2·00	380	1·60	260	1·60	260	0·80	74	1·05	120	1·00	108
9	1·90	350	1·55	245	1·50	230	0·85	80	1·10	130	0·95	98
10	2·05	395	1·50	230	1·40	205	0·90	89	1·20	155	0·90	89
11	2·10	410	1·45	215	1·30	180	2·10	410	1·15	140	0·90	89
12	2·05	395	1·45	215	1·25	170	2·70	610	1·05	120	0·90	89
13	2·10	410	1·40	205	1·20	155	2·70	610	1·00	108	0·85	80
14	2·00	200	1·35	195	1·15	145	2·25	455	0·95	98	0·80	74
15	1·80	320	1·35	195	1·10	130	1·95	365	0·95	98	0·85	80
16	1·70	290	1·30	180	1·05	120	1·70	290	1·80	320	0·80	74
17	1·65	275	1·30	180	1·05	120	1·50	230	1·80	320	0·80	74
18	1·65	275	1·35	195	1·15	145	1·45	220	1·65	275	0·80	74
19	1·70	290	1·30	180	1·15	145	1·35	190	1·50	230	0·75	70
20	1·95	365	1·20	155	1·10	130	1·30	180	1·35	190	0·75	70
21	2·10	410	1·15	145	1·05	120	1·25	165	1·25	165	0·75	70
22	2·15	425	1·15	145	1·20	155	1·20	155	1·15	140	0·70	63
23	2·15	425	1·25	170	1·15	145	1·25	165	1·10	130	0·65	60
24	2·10	410	1·25	170	1·05	120	1·45	215	1·50	230	0·65	60
25	2·05	395	1·25	170	1·00	108	1·45	215	1·65	275	0·65	60
26	1·90	350	1·25	170	1·00	108	1·35	190	1·50	230	0·60	55
27	1·85	335	1·20	155	0·95	98	1·30	180	1·45	220	0·60	55
28	1·80	320	1·20	155	1·05	120	1·20	155	1·40	205	0·60	55
29	1·95	365	1·20	155	1·05	120	1·15	140	1·35	190	0·60	55
30	1·75	305	1·20	155	1·00	108	1·05	120	1·30	180	0·60	55
31	1·65	275	1·20	155			1·05	120			0·60	55

MESLILOET RIVER.

Location.—Near mouth of Canyon, 8 miles from mouth of river, in section 8, township 7, range 7, west of 7th meridian.

Records Available.—Continuous since October 31, 1912.

Winter Conditions.—Open water all year.

Gauge.—Vertical staff gauge, four or five readings a week.

Channel.—Bed of stream rocky, water swift at higher stages.

Discharge Measurements.—One measurement in 1912 and nine in 1913 are well distributed and do not show any great discrepancy.

Accuracy.—Meter measurements good and gauge readings nearly every day should give good results.

MESLILOET (INDIAN) RIVER.

Mesliloet or Indian river has its source in the mountains east of Howe sound at an elevation of some 3,000 feet, and discharges into the North Arm of Burrard inlet at sea-level. The drainage area above the mouth is estimated at 75 square miles. About 7 miles from the mouth of the river there is a canyon which provides a good site for power development. A gauging station has been established at this point, and the drainage area lying above it is estimated at 65 square miles.

The watershed of the Mesliloet river is quite mountainous and lies close to the coast. On this account it receives quite a heavy precipitation, amounting to between 120 and 150 inches. There is a heavy snowfall in the winter, particularly in the higher altitudes. Winter thaws and rains are frequent, and these often cause winter freshets.

The more important tributaries are: Hixon creek, Brandt creek, and the Left Fork. These streams all enter from the east. There are no tributaries of any importance entering from the west.

There is considerable good timber in the watershed, consisting mostly of fir and cedar. A certain amount of the cedar has been cut into shingle bolts, but very little fir has been removed as yet. The stream has been used for running shingle bolts, but is not suitable for running logs. It will be necessary to build a railroad to get the logs out. Messrs. Brittenham & Young, of Maddison, Wis., who own much of the timber in the valley, are said to be planning to build a saw-mill on Burrard inlet, at the mouth of the Mesliloet river. Booming grounds have already been laid out, but nothing further has been done as yet.

The Indian River Park Company has built a summer hotel, Wigwam Inn, and laid out a small park near the mouth of the river. The place is getting to be quite a pleasure resort, and the company's steamer makes regular trips to Vancouver during the summer.

There are good gravel deposits at the mouth of the Mesliloet river. A couple of dredges are usually working there supplying gravel for use in the city of Vancouver.

Salmon run up the river for several miles, and a good catch is made every year by the Indians who have a small reserve near the mouth.

There is very little agricultural land in the Mesliloet valley, and what little there is, is mostly covered with heavy timber at present. There is no agricultural development in the valley except a small garden near the Indian reserve.

At the canyon there is a good site for power development. A dam could be raised at this point to a height of 50 feet or more, and it would give splendid storage in the valley above. A 2½-mile pipe line could develop a head of about 350 feet. On the two tributaries, Brandt and Hixon, a high-head development of some 2,000 feet is possible. These streams and their tributaries, Young and Belknap, have good storage facilities, though their combined flow is not nearly as great as that of the Mesliloet proper. The Westminster Power Company, which has applied for the water rights on the main river and also on the tributaries, proposes to place the machinery for its two developments in the one power-house, to be situated near the mouth of Brandt creek.

The Mesliloet river can be reached by boat from Vancouver. There is a landing place at the Wigwam Inn. From the landing there is a trail going up towards the wagon road, but there is no bridge across the river. The best way of getting to the wagon road is by using a canoe or small boat from the hotel. The road runs up the valley some 6 miles to an abandoned logging camp. Horses using this trail must ford the river at three places. There is a suspension foot bridge at the lower ford and a foot trail connecting the two upper fords, so that it is not necessary to cross the river at these points when travelling on foot. From the camp there is a foot trail up the main valley, and this has recently been run through to Squamish for the convenience of fire rangers. There is also a regular pack trail from the camp to Norton lake. This trail has been laid out and cleared so that pack horses can travel it. A cabin at Norton lake provides headquarters for the gauge readers to the upper stations. From this cabin there are trails leading to upper Brandt creek, Young creek, Ann lake, Belknap lake, and upper Hixon creek. At present there are no horses in the valley. All travelling must be done on foot, and the gauge readers pack in their own supplies. Sometimes supplies can be conveyed up the river to the lumber camp by canoe.

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A gauging station was maintained for a year at the mouth of the Mesliloet river, but in October, 1912, a new station was established close to the canyon to take its place. Regular readings are being taken at this latter station which gives the exact amount of water available at the proposed intake site. There are also a number of gauging stations on the tributary streams, to give the necessary data in connection with the high-head development. They are as follows: Brandt creek and tributaries—Brandt at mouth, Brandt above Young creek, Young creek at mouth, Norton creek at Norton lake; Hixon creek and tributaries—Hixon creek at mouth, Hixon creek above Belknap creek, Belknap creek at Belknap lake, Belknap creek below Ann lake.

DISCHARGE MEASUREMENTS of Mesliloet River at Upper Station, 1912, and 1913

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Oct. 31	C. G. Cline	1,046	70	120·0	1·57	2·26	188
1913.							
June 6	H. C. Hughes	1,673	80	232·0	2·90	3·25	662
" 13	do	1,673	80	239·5	3·12	3·40	713
" 17	do	1,673	80	195·0	2·40	2·90	446
July 3	do	1,673	80	203·4	2·40	2·98	471
" 29	do	1,673	75	146·0	1·65	2·28	230
Sept. 17	C. G. Cline	1,673	70	109·0	1·16	1·87	122
Oct. 9	F. MacLachlan	1,673	77	81·0	0·94	1·61	76·5
Nov. 10	do	1,521	83	186·0	2·20	2·86	417
" 16	do	1,521	85	277·0	3·47	3·58	942

MONTHLY DISCHARGE of Mesliloet River at Canyon—8 miles from Mouth for 1913

(Drainage area, 65 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	147	60	78	1·2	1·38	4,800
February	1,720	50	283	4·4	4·58	15,700
March	222	72	131	2·0	2·31	8,055
April	690	89	337	5·2	5·80	20,000
May	1,370	180	645	10·0	11·53	39,700
June	1,290	436	716	11·0	12·27	42,600
July	1,110	185	449	7·0	8·07	27,600
August	368	106	188	3·0	3·46	11,560
September	485	89	214	3·3	3·68	12,700
October	2,120	72	293	4·5	5·18	18,000
November	1,880	98	594	9·1	10·15	35,300
December	755	115	269	4·1	4·72	16,540
The year	2,120	50	350	5·4	73·10	252,600

NOTE.—Accuracy "A" and "C".

Monthly Discharge of Mesliloet River at Canyon, 8 miles from Mouth, for 1912.

(Drainage area 65 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum	Minimum.	Mean	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet
November	1,720	160	599	9·2	10·3	34,500
December	1,510	136	246	3·8	4·4	14,600

Note.—Accuracy "A" and "C".

Daily Gauge Heights and Discharges of Mesliloet River near Canyon for 1912.

Day.	October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			2·15	182	2·05	160
2				225		195
3				268	2·35	237
4			2·6	311		223
5			3·15	570	2·05	160
6				545		177
7				520	2·0	147
8				495	1·95	136
9				470		160
10				445		196
11			2·85	420	2·3	222
12				1,070	2·3	22 2
13			4·8	1,720	4·5	1,510
14			3·25	620	2·8	389
15				585	2·4	251
16				550		251
17			3·05	515	2·4	251
18			4·8	1,720	2·75	368
19			4·55	1,545	2·3	222
20			3·5	790	2·2	195
21			3·9	1,080		188
22				810	2·15	182
23			3·1	540		164
24			3·15	570	2·0	147
25			2·7	347		141
26			2·45	266	1·95	136
27			2·35	237	2·3	222
28			2·2	195	2·1	170
29				201		182
30			2·05	160	2·2	195
31	2·25	208			2·3	222

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Daily Gauge Heights and Discharges of Mesliloet River, near Upper Station for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·0	147	....	69	1·6	72	1·7	89	.....	210	.....	1,130
2	1·95	136	1·55	66	.....	72	.....	100	2·2	195	4·2	1,290
3	1·9	125	.....	66	1·6	72	1·8	106	.....	190	.....	1,080
4	.....	107	1·55	66	.....	84	2·0	147	.....	185	.....	870
5	1·7	89	.....	63	1·75	97	2·2	195	2·15	180	3·3	660
6	1·7	89	1·5	60	1·85	115	.....	170	.....	300	3·25	630
7	.....	86	.....	58	.....	155	2·0	147	2·85	415	3·4	720
8	.....	83	1·45	55	.....	188	2·0	147	3·2	595	.....	670
9	1·65	80	.....	55	2·3	222	2·2	195	.....	840	3·25	620
10	.....	75	1·45	55	2·1	170	2·45	265	3·9	1,080	.....	640
11	.....	70	.....	52	.....	180	.....	415	.....	950	.....	660
12	1·55	66	1·4	50	2·1	170	3·15	565	3·55	825	3·35	690
13	.....	66	.....	470	.....	160	2·8	389	3·2	595	3·4	720
14	1·55	66	.....	890	.....	148	.....	363	.....	666	3·4	720
15	.....	64	.....	1,300	1·95	136	.....	337	3·4	720	.....	680
16	.....	62	4·8	1,720	.....	165	2·6	311	.....	580	3·25	620
17	1·5	60	.....	1,050	.....	195	2·65	330	2·9	436	2·9	436
18	.....	60	2·8	389	2·3	222	2·85	415	.....	470	2·85	415
19	1·5	60	2·4	251	2·3	222	3·3	660	.....	500	.....	600
20	.....	60	.....	200	.....	168	.....	675	3·1	540	3·5	790
21	1·5	60	2·05	160	1·85	115	3·35	690	.....	600	4·0	1,150
22	1·5	60	.....	145	.....	105	.....	540	.....	660	3·45	755
23	.....	65	.....	135	.....	90	2·8	389	3·4	720	.....	730
24	.....	70	.....	120	1·65	80	2·45	265	3·3	660	.....	710
25	.....	75	1·8	106	.....	75	.....	375	.....	940	.....	690
26	1·65	80	.....	95	.....	75	3·0	485	4·1	1,220	3·3	660
27	.....	76	1·7	89	1·6	72	.....	437	4·3	1,370	3·2	595
28	1·6	72	1·65	80	.....	100	2·8	389	.....	1,000	.....	560
29	.....	72	.....	.....	1·9	125	.....	305	3·3	660	3·05	520
30	.....	72	.....	.....	.....	115	2·3	222	.....	720	.....	510
31	1·6	72	.....	.....	1·8	106	.....	.....	.....	970	.....	.....

DAILY GAUGE HEIGHTS AND DISCHARGES of Mesliloet River near Upper Station for 1913—*Concluded.*

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	500	2·3	222	.....	230	.....	140	.....	100	2·7	347
2	.....	595	2·3	222	.....	260	.....	120	1·85	115	.....	290
3	3·0	485	.....	222	.....	290	1·75	98	1·75	98	2·35	235
4	3·0	485	2·3	222	.....	320	.....	85	.....	214	.....	235
5	3·05	520	.....	204	.....	370	1·6	72	2·65	330	2·35	235
6	3·95	1,110	2·15	185	.....	410	.....	72	2·55	295	.....	250
7	3·4	720	2·1	170	.....	450	.....	72	.....	640	2·45	265
8	3·1	540	2·1	170	3·0	485	.....	72	.....	980	2·25	210
9	2·15	185	.....	165	2·8	389	1·6	72	4·25	1,330	.....	190
10	.....	310	.....	165	2·65	329	.....	400	2·9	436	2·1	170
11	2·9	436	2·05	160	.....	260	3·4	720	.....	310	.....	280
12	.....	390	2·1	170	2·2	195	5·3	2,120	2·15	185	2·8	389
13	.....	340	.....	190	2·1	170	4·2	1,290	.....	150	.....	570
14	2·55	295	2·25	210	.....	150	.....	820	1·85	115	3·45	755
15	2·55	295	.....	250	1·9	125	2·7	347	.....	550	3·05	520
16	.....	385	.....	290	1·9	125	2·55	295	3·78	990	2·8	389
17	.....	475	.....	330	1·85	115	.....	270	.....	600	.....	327
18	3·15	565	2·75	368	1·85	115	.....	240	2·25	210	2·45	265
19	3·3	660	.....	258	1·8	106	.....	210	2·25	210	.....	230
20	.....	615	2·0	147	1·8	106	2·15	185	.....	180	.....	190
21	.....	570	2·0	147	.....	115	.....	160	2·0	147	2·0	147
22	.....	525	2·0	147	1·9	125	1·95	136	2·0	147	.....	147
23	.....	480	2·0	147	1·8	106	.....	160	.....	1,010	2·0	147
24	2·9	436	.....	136	.....	95	2·15	185	5·0	1,880	.....	130
25	2·8	389	1·9	125	1·7	89	.....	150	4·7	1,650	1·85	115
26	.....	355	1·9	125	1·7	89	1·85	115	4·3	1,370	.....	184
27	2·65	320	.....	119	1·8	106	1·8	106	3·9	1,080	2·4	251
28	2·5	280	.....	113	2·65	330	.....	100	.....	1,050	2·1	170
29	2·3	222	1·8	106	2·2	195	1·75	98	3·8	1,010	.....	200
30	.....	222	.....	145	2·05	160	1·65	80	2·9	436	.....	240
31	2·3	222	.....	185	.....	.....	.....	90	.....	.....	2·5	280

NORTH LILLOOET RIVER.

Location.—Five miles from mouth of stream, in section 29, township 12, east of Coast meridian.

Records Available.—Continuous records from October 27, 1911, to December 11, 1913.

Winter Conditions.—Open water all year.

Gauge.—Vertical staff gauge on bridge pile. Daily gauge readings.

Channel.—Gravel bottom, water deep and quiet at gauge.

Discharge Measurements.—Two measurements in 1911, five in 1912, and one in 1913 show fair agreement and are well distributed except for the highest stages.

Accuracy.—Records should be quite accurate.

NORTH LILLOOET RIVER.

The North Lillooet river has its source in the Golden Ears mountain (5560 feet) at an elevation of 4,000 feet. It joins the South Lillooet river 2 miles from Pitt river about 20 feet above sea-level. The drainage area is about 20 sq. miles, and precipitation varies from 70 inches at the mouth to 80 inches or more at the headwaters. The stream is open all the year round, and the winter conditions are not severe. About 5 miles above the mouth the North Lillooet

is within a few hundred feet of the South Lillooet. West of that point both streams flow through rich bottom lands, are deep and sluggish, and at high water often overflow the surrounding lands. Some of these are being dyked and farmed, and are very valuable. The upper part of the watershed is mountainous. A prominent peak, mount Blanchard, known locally as the Golden Ears, rises to an elevation of 5500 feet. This peak is snowcapped practically all the year round. In the upper part of the stream the bed has a very rapid fall, and during high water many trees are washed out and carried down into the flats, where they give much trouble by obstructing the channel and causing the river to overflow and sometimes even to change its course.

Near the northern boundary of township 12, E. C. M., there is a series of falls on the stream with a total drop of some 60 feet in about 200 yards. A company has a water record to use water for power purposes at this point, in connection with a proposed rock quarry. The municipality of Maple Ridge plans to draw its water supply from the stream above the falls.

The station was established by C. G. Cline on October 27 1911, and gauge readings were taken continuously till December, 1913. It was located at the bridge on the North Lillooet river at Sibley's blacksmith shop, just below a high-water slough from the South Lillooet river, and directly north of Port Haney. The gauge is a standard vertical staff gauge 7½ feet long, and is nailed to the south side of the planking on the piling of the bridge near the right bank. It is referred to three permanent bench-marks.

DISCHARGE MEASUREMENTS of North Lillooet River, 5 Miles from Mouth, 1911 and 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Oct. 27.....	Cline and Smith.....	1,057	47	16·3	1·79	4·35	291
Dec. 19.....	H. M. Smith.....	1,057	16	13·0	0·87	2·28	11·3
1912.							
Mar. 16.....	C. G. Cline.....	1,046	19	24·6	0·7	2·60	17·3
July 4.....	do	1,046	32	24·7	0·92	2·7	22·8
Aug. 17.....	do	1,046	39	44·7	2·16	3·65	96·2
Sept. 10.....	do	1,046	32	27·0	1·30	2·89	35·1
Nov. 14.....	do	1,046	42	115·0	1·48	3·91	170
1913.							
July 11.....	K. G. Chisholm.....	1,055	34	44·3	2·32	3·48	102

Monthly Discharge of North Lillooet River, 5 miles from Mouth, for 1913.

(Drainage area, 20 square miles.)

Month.	Discharge in Second-feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	865	29	77·1	3·85	4·44	4,740
February	1,535	20	174·1	8·70	9·38	9,660
March	1,197	20	118·6	5·93	6·84	7,320
April	470	42	138·1	6·91	7·71	8,210
May	590	35	151·2	7·56	8·72	9,280
June	287	50	83·7	4·18	4·66	4,980
July	243	20	61·2	3·06	3·53	3,760
August	188	14	28·4	1·42	1·64	1,750
September	400	8	39·3	1·96	2·19	2,340
October	1,220	9	151·8	7·59	8·75	9,350
November	1,580	14	228·3	11·40	12·72	13,600
December	400	42	77·9	3·90	4·50	4,790
The year	1,580	8	111·0	5·54	75·10	79,800

Daily Gauge Heights and Discharges of North Lillooet River 5 miles from Mouth, for 1913

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft
1	3·7	123	3·0	42	2·6	20	3·1	50	3·0	42	4·0	188
2	3·4	81	3·0	42	2·7	24	3·0	42	2·9	35	3·7	123
3	3·4	81	3·0	42	2·7	24	3·0	42	2·9	35	3·5	93
4	3·2	59	2·9	35	2·7	24	3·0	42	3·0	42	3·5	93
5	3·4	81	2·9	35	2·8	29	4·0	188	3·0	42	3·2	59
6	3·0	42	2·8	29	3·2	59	3·9	163	3·5	93	3·1	50
7	3·0	42	2·8	29	3·4	81	3·5	93	3·4	81	3·4	81
8	2·9	35	2·8	29	3·5	93	3·2	59	3·7	123	3·4	81
9	2·9	35	2·8	29	3·4	81	3·2	59	4·2	243	3·2	59
10	2·8	29	2·8	29	3·3	69	3·4	81	4·0	188	3·1	50
11	2·8	29	2·8	29	3·2	59	4·0	188	5·2	590	3·1	50
12	2·8	29	2·7	24	3·1	50	4·2	243	4·7	400	3·4	81
13	2·8	29	2·6	20	3·0	42	3·8	141	4·2	243	3·2	59
14	3·8	29	3·25	64	3·0	42	3·6	107	4·6	365	3·2	59
15	2·8	29	7·2	1,445	2·9	35	3·5	93	4·45	319	3·4	81
16	2·8	29	7·4	1,535	3·4	81	3·3	69	4·0	243	3·6	107
17	2·8	29	5·65	770	6·65	1,197	3·3	69	3·6	107	3·2	59
18	2·8	29	4·2	243	5·3	630	3·7	123	3·5	93	3·1	50
19	3·8	29	3·6	107	3·8	141	3·2	243	3·5	93	3·3	69
20	2·7	24	3·2	59	3·6	107	4·9	470	3·3	69	3·9	163
21	2·7	24	3·1	50	2·9	35	4·5	335	3·3	69	3·4	81
22	2·7	24	2·9	35	2·9	35	4·7	400	3·5	93	3·4	81
23	3·0	42	2·9	35	2·8	29	3·3	69	3·5	93	3·2	59
24	3·0	42	2·8	29	2·75	27	3·5	93	3·7	123	3·1	50
25	5·0	865	2·7	24	2·7	24	3·6	107	3·6	107	3·2	59
26	4·0	188	2·7	24	2·65	22	4·4	303	3·9	163	3·1	50
27	3·5	93	2·6	20	2·7	24	3·4	81	4·2	243	3·1	50
28	3·3	69	2·6	20	2·9	35	3·4	81	3·6	107	3·1	50
29	3·2	59	.....	.....	4·5	335	3·2	59	3·3	69	3·3	69
30	3·1	50	.....	.....	3·8	141	3·1	50	3·3	69	4·35	287
31	3·0	42	.....	.....	3·4	81	.....	.....	3·6	107	.....	.....

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DAILY GAUGE HEIGHTS AND DISCHARGES of North Lillooet River, 5 miles from Mouth, for 1913.

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	4·1	215	2·6	20	2·4	14	2·4	14	2·5	17	4·7	400
2	3·8	141	2·6	20	2·4	14	2·3	11	2·5	17	4·5	335
3	3·5	93	2·6	20	3·9	163	2·2	9	2·4	14	4·3	272
4	3·3	69	2·6	20	4·7	400	2·2	9	2·4	14	3·2	59
5	3·2	59	2·5	17	3·8	141	2·2	9	4·2	243	3·1	50
6	3·2	59	2·5	17	3·2	59	2·2	9	5·6	750	3·0	42
7	3·2	59	2·5	17	2·9	35	2·4	14	3·5	93	3·5	93
8	3·1	50	2·4	14	2·7	24	2·4	14	3·4	81	3·1	50
9	3·1	50	2·4	14	2·8	29	2·6	20	3·85	152	3·0	42
10	4·2	243	2·5	17	2·7	24	3·0	42	3·4	81	2·8	29
11	3·5	993	2·5	17	2·5	17	6·6	1,175	3·1	50	3·0	42
12	3·2	59	2·6	20	2·5	17	6·7	1,220	2·8	29	.....	50
13	3·2	559	2·6	20	2·4	14	6·7	1,220	2·7	24	.....	50
14	3·2	59	2·6	20	2·3	11	4·5	335	2·6	200	.....	50
15	3·0	42	2·9	35	2·3	11	3·8	141	2·7	24	.....	50
16	2·9	35	2·6	20	2·3	11	3·4	81	6·75	1,242	.....	50
17	3·05	46	2·7	24	2·3	11	3·0	42	4·4	303	.....	50
18	3·0	42	4·0	188	2·3	11	2·9	35	3·4	81	.....	50
19	3·0	42	3·7	123	2·3	11	2·9	35	3·3	69	.....	50
20	3·0	42	8·9	35	2·2	9	2·8	299	3·5	93	.....	50
21	3·1	50	2·8	29	2·2	9	2·6	20	3·0	69	[1]	50
22	3·0	42	2·7	24	2·5	17	2·6	20	3·1	50	.....	50
23	2·95	39	2·7	24	2·3	11	2·8	29	3·4	81	.....	50
24	2·9	35	2·6	20	2·2	9	2·8	29	7·5	1,580	.....	50
25	2·8	29	2·5	17	2·2	9	2·8	29	5·0	510	.....	50
26	2·8	29	2·5	17	2·2	9	2·7	24	4·6	365	.....	50
27	2·7	24	2·5	17	2·15	8	2·6	20	3·2	59	.....	50
28	2·7	24	2·4	14	3·1	50	2·5	17	4·0	188	.....	50
29	2·7	24	2·4	14	2·5	17	2·5	17	4·5	335	.....	50
30	2·7	24	2·4	14	2·4	14	2·5	17	4·1	215	.....	50
31	2·6	20	2·4	14	.....	.....	2·6	20	.....	.....	.....	.....

[1] Estimated.

NORTON CREEK.

Location.—At Norton lake, in section 10, township 7, range 7, west of 7th meridian.

Records Available.—Continuous records since October 20, 1912.

Winter Conditions.—Very heavy snowfall, and lake freezes over, but very little ice in stream at gauging station.

Gauge.—Vertical staff gauge. Gauge readings irregular, one or two a week.

Channel.—Rocky and permanent.

Discharge Measurements.—One measurement in 1912 and seven in 1913 show good agreement, and cover all except the highest stages.

Accuracy.—The infrequency of the gauge readings will tend to impair the accuracy of the results.

NORTON CREEK.

Norton creek has its source in Norton lake, at an elevation of 2,100 feet, and discharges into Brandt creek about a mile from its mouth, at an elevation of 1,500 feet. It is part of Burrard Inlet drainage.

The rainfall around Norton lake is something over 120 inches. In the winter there is generally a snowfall of 3 or 4 feet or more. The lake freezes over, but the stream generally remains open.

The Westminster Power Company proposes to include Norton lake in its high-head power development. The lake is to be used as the main storage and equalizing reservoir. Water from upper Brandt creek, Norton lake, and Belknap creek is to be diverted into Norton lake. A large dam is to be constructed at the outlet of the lake to provide storage and to regulate the entrance of water into the pipes. The main pipeline is to lead from Norton lake to a small reservoir on the hill above the power-house. From the reservoir, steel penstocks will lead down to the power-house, which is to be situated near the mouth of Brandt creek. A head of some 2,000 feet will be developed by this installation. Storage in Norton, Young, and Ann lakes will give a very uniform flow, and conserve practically all the freshet water for use during the low-water seasons.

A cabin has been constructed at Norton lake, and it is to be made the headquarters for the gauge readers. From this cabin, trails lead to upper Brandt creek, Young lake, Belknap lake, and Hixon creek. A horse trail connects the cabin with the camp in the main Mesliloet valley, and a wagon road leads from there to Burrard Inlet.

A gauging station was established on the 20th of October, 1912, by this survey on Norton creek at Norton lake. This station has been maintained since that date, but the gauge readings have been somewhat irregular as the gauge readers had their headquarters in the lower valley, and the travelling is very difficult in the winter on account of the deep snow and the steep climb. The gauging station gives the flow from Norton lake, and the total amount of the water measured by it could be used in the proposed water-power development. The transfer of the gauge readers' headquarters to Norton lake in 1914 should give more reliable results in the future.

DISCHARGE MEASUREMENTS of Norton Creek at Norton lake, 1912 and 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec. ft.
Oct. 20.....	C. G. Cline.....	1,046	9·0	11·8	0·64	2·53	7·58
1913.							
June 3.....	H. C. Hughes.....	1,673	16·0	16·0	1·02	2·85	16·30
" 10.....	do	1,673	8·5	9·3	1·00	2·60	9·34
" 24.....	do	1,673	8·0	7·5	0·76	2·52	5·75
July 7.....	do	1,673	10·0	13·3	0·58	2·53	7·72
" 23.....	do	1,673	6·0	6·4	0·27	2·11	1·76
Aug. 2.....	do	1,673	6·0	5·15	0·10	1·85	0·50
Sept. 23.....	F. MacLachlan.....	1,673	3·5	1·95	0·93	2·06	[1]1·82

NOTE.—[1]Different section.

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Monthly Discharge of Norton Creek below Norton lake for 1913.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
January	3·6	1·9	2·5	154
February	11·0	1·2	3·9	217
March	3·7	2·7	2·9	178
April	8·6	2·7	6·4	380
May	36·0	5·2	19·0	1,170
June	16·0	6·0	8·7	518
July	7·3	1·0	3·8	234
August	1·9	0·5	0·86	53
September	30·0	1·2	7·0	416
October	52·5	1·2	9·5	584
November	69·0	3·1	23·8	1,416
December	21·0	6·4	10·0	615
The year	69·0	0·5	8·2	5,935

Note.—Accuracy "A" and "C".

Monthly Discharge of Norton Creek below Norton lake for 1912.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
November	27·0	9·0	15·5	920
December	11·0	3·7	5·63	346

Note.—Accuracy "A".

Daily Gauge Heights and Discharges of Norton Creek at Norton lake for 1912.

Day.	October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	.....	11·0	.....	8·0
2	.....	.....	.....	11·5	.....	7·5
3	.....	.....	.....	12·0	2·5	6·7
4	.....	.....	.....	12·5	.....	5·5
5	.....	.....	.....	13·0	.....	4·3
6	.....	.....	.....	13·0	.....	3·1
7	.....	.....	.....	13·5	2·1	1·9
8	.....	.....	2·8	14·0	.....	2·5
9	.....	.....	2·7	11·0	.....	3·1
10	.....	.....	2·7	11·0	2·3	3·7
11	.....	.....	.....	12·0	.....	5·5
12	.....	.....	.....	13·0	.....	7·3
13	.....	.....	.....	14·0	.....	9·1
14	.....	.....	.....	15·0	2·7	11·0
15	.....	.....	.....	17·0	.....	10·1
16	.....	.....	.....	18·0	.....	9·2
17	.....	.....	.....	20·0	.....	8·4
18	.....	.....	.....	22·0	.....	7·6
19	.....	.....	.....	23·0	.....	6·8
20	2·5	6·7	.....	24·0	.....	6·0
21	.....	7·0	.....	25·0	2·4	5·2
22	.....	7·0	.....	26·0	.....	4·9
23	.....	7·5	3·1	27·0	.....	4·6
24	.....	8·0	.....	22·0	2·35	4·4
25	.....	8·0	.....	17·0	.....	4·3
26	.....	8·5	2·7	11·0	.....	4·2
27	.....	9·0	.....	10·5	.....	4·1
28	.....	9·5	.....	10·0	.....	4·0
29	.....	10·0	.....	9·5	.....	3·9
30	.....	10·5	.....	9·0	.....	3·8
31	.....	11·0	.....	.....	.....	3·7

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Daily Gauge Heights and Discharges of Norton Creek near Norton lake for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1		3·6		2·2		2·7		2·7	2·5	6·7		16·0
2		3·5		2·1		2·7	2·2	2·7		6·4		16·0
3		3·4		2·0		2·7		2·9		6·1	2·85	16·0
4		3·3		2·0		2·7		3·0		5·8		15·0
5		3·2	2·1	1·9		2·7		3·2		5·5		14·0
6		3·1		1·8		2·7		3·4	2·4	5·2		12·5
7		3·0	2·07	1·7	2·2	2·7		3·5		12·0	2·7	11·0
8		2·9		1·6		2·7	2·3	3·7		20·0		10·0
9		2·8		1·5		2·7		4·4		28·0	2·6	8·6
10		2·7		1·4		2·7		5·1	3·3	36·0		8·3
11	2·2	2·7		1·3	2·2	2·7		5·8		34·0		7·9
12		2·6		1·2		2·7		6·5		32·0		7·5
13		2·5	2·0	1·2		2·7		7·2		30·0		7·1
14		2·24		2·6	2·2	2·7	2·55	7·7		28·5	2·5	6·7
15		2·3		4·0		3·0		8·0	3·1	27·0		6·7
16		2·2		5·4		3·2		8·2		25·0		6·7
17		2·0		6·8		3·4		8·4		22·0		6·7
18	2·1	1·9		8·2		3·6	2·6	8·6		19·0		6·7
19		1·9		9·6	2·3	3·7		8·6	2·85	16·0	2·5	6·7
20		2·0	2·7	11·0		3·5		8·6		17·0		6·7
21		2·0		9·4		3·3		8·6		17·0		6·7
22		2·0		7·8	2·25	3·2	2·5	8·6		17·5		6·7
23		2·0		6·2		3·0		8·4	2·	18·0		6·7
24		2·1		5·6		2·9		8·2		19·0	2·5	6·7
25		2·1	2·2	2·7		2·8		8·0		19·5	2·5	6·7
26		2·1		2·7	2·2	2·7		7·8		20·0		6·5
27		2·2		2·7		2·7		7·6		21·0		6·3
28		2·2		2·7		2·7		7·4	3·0	22·0	2·45	6·0
29		2·2				2·7		7·2		19·0		6·1
30	2·15	2·3				2·7		7·0	2·85	16·0		6·2
31		2·3				2·7			2·85	16·0		

DAILY GAUGE HEIGHTS AND DISCHARGES of Norton Creek near Norton lake for 1913—*Concluded.*

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	6·3	.....	0·8	.....	10·0	.....	1·9	.....	3·1	.....	21·0
2	.....	6·4	1·85	0·5	.....	15·0	.....	1·5	.....	3·7	.....	16·0
3	.....	6·5	.....	0·5	.....	20·0	2·0	1·2	.....	4·1	.....	11·0
4	.....	6·6	.....	0·5	.....	25·0	.....	1·2	.....	4·5	2·6	8·6
5	2·5	6·7	1·85	0·5	3·15	30·0	.....	1·2	.....	4·9	.....	8·8
6	.....	7·0	.....	0·5	2·9	18·0	.....	1·2	.....	5·5	.....	9·0
7	2·53	7·3	.....	0·5	2·8	14·0	.....	1·2	.....	6·1	.....	9·2
8	2·45	5·9	.....	0·5	.....	12·0	.....	1·2	2·5	6·7	.....	9·4
9	2·45	5·9	1·85	0·5	.....	10·0	2·0	1·2	.....	6·5	.....	9·6
10	.....	5·6	.....	0·5	2·6	8·6	.....	4·8	.....	6·3	.....	9·8
11	.....	5·4	.....	0·5	2·55	7·7	2·6	8·6	.....	6·2	.....	10·0
12	2·4	5·2	.....	0·5	.....	5·2	3·53	47·0	.....	6·1	.....	10·2
13	.....	5·0	.....	0·5	2·2	2·7	3·65	52·5	2·45	6·0	.....	10·4
14	.....	4·6	.....	0·5	2·2	2·7	.....	40·0	.....	11·0	.....	10·5
15	.....	4·2	1·85	0·5	.....	2·6	.....	27·0	.....	16·0	.....	10·6
16	2·3	3·7	1·85	0·5	.....	2·4	2·8	11·0	.....	21·0	.....	10·7
17	2·3	3·7	.....	1·0	.....	2·2	.....	13·0	.....	26·0	.....	10·8
18	.....	3·2	.....	1·5	.....	2·0	.....	12·0	.....	31·0	.....	10·9
19	2·2	2·7	2·1	1·9	2·1	1·9	.....	11·0	.....	36·0	2·7	11·0
20	.....	2·4	.....	1·5	.....	1·8	.....	10·0	.....	41·0	.....	10·6
21	.....	2·1	.....	1·0	.....	1·7	.....	8·0	.....	46·0	.....	10·2
22	2·1	1·9	1·9	0·7	.....	1·7	.....	7·0	.....	51·0	.....	9·8
23	2·1	1·9	.....	0·7	2·06	1·6	.....	6·0	.....	56·0	.....	9·4
24	.....	1·6	.....	0·7	.....	1·5	.....	5·0	3·8	60·0	.....	9·0
25	.....	1·3	.....	0·7	.....	1·4	2·23	3·0	4·0	69·0	.....	8·6
26	1·95	1·0	.....	0·7	2·0	1·2	.....	2·7	3·5	46·0	.....	8·2
27	.....	1·0	1·9	0·7	.....	1·7	.....	2·4	.....	41·0	.....	7·8
28	.....	1·1	.....	0·7	.....	2·2	.....	2·1	.....	36·0	.....	7·4
29	.....	1·1	.....	0·7	2·2	2·7	2·1	1·9	.....	31·0	.....	7·0
30	2·0	1·2	1·9	0·7	2·15	2·3	2·1	1·9	.....	26·0	2·5	6·7
31	2·9	1·2	.....	5·0	.....	.....	.....	2·5	.....	.....	.....	6·4

RAINBOW CREEK.

Location.—Below falls, near mouth, in section 18, township 6, range 4, west of 7th meridian.

Records Available.—Continuous records from November 1, 1912, to November 31, 1913.

Winter Conditions.—Open water all season.

Gauge.—Vertical staff gauge—gauge readings about once a week.

Channel.—Permanent rocky channel.

Discharge Measurements.—Two measurements in 1911, two in 1912, and two in 1913 show good agreement, and cover all but the highest stages.

Accuracy.—The infrequency of the guage readings will tend to impair the accuracy of the results.

RAINBOW CREEK.

Rainbow creek has its source in the mountains on the east side of Pitt lake, outside the Railway Belt, at an elevation of 2,000 feet, and discharges into Pitt lake at an elevation of 10 feet. It is part of the Pitt-Fraser drainage. The drainage area is estimated at 20 square miles, and the annual precipitation at about 70 inches. The watershed of Rainbow creek is comparatively high, rocky, and wooded, with snow most of the year in the higher altitudes.

It would be possible to develop power on Rainbow creek, there being a 630-foot fall in half a mile near the mouth. There is said to be a lake near the headwaters which might be utilized as a storage reservoir. There is a small flat at the mouth which would provide plenty of room for a power-house.

The gauging station on Rainbow creek was established on November 11, 1911, by C. G. Cline, and a year's records have been obtained. It is about 2 miles above Goose island, on the east side of Pitt lake. The gauge is a vertical staff, 7 feet long, and is fastened to a stump, 100 feet below the high fall, and 300 yards from the mouth of the creek. The datum of the gauge is referred to three bench-marks. Measurements are made by wading, except at high water, when a boat is used. The station is just at the edge of a pool at the bottom of the fall.

DISCHARGE MEASUREMENTS of Rainbow Creek below falls, 1911, 12, 13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Nov. 11	C. G. C. & K. H. S	1,053	42	61	0·7	0·82	46·0
Dec. 28	K. H. Smith	1,057	36	43	1·2	0·85	51·0
1912.							
Aug. 7	C. G. Cline	1,046	33	46	0·7	0·64	32·4
Nov. 2	C. G. Cline	1,046	36	75	1·0	0·15	74·6
1913							
May 24	C. G. Cline	1,044	75	310	1·3	2·3	412
July 16	K. G. C. & C. G. C	1,055	42	76	2·2	1·55	166

MONTHLY DISCHARGE of Rainbow Creek near mouth for 1912.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
November	133	33	75·6	4,498
December	158	62	101·0	6,210

MONTHLY DISCHARGE of Rainbow Creek at mouth for 1913.

(Drainage area, 20 square miles.)

Month.	Discharge in Second-Feet.			Run-Off.		
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	120	34	60·4	3·02	3·48	3,710
February	123	34	70	3·5	3·6	3,890
March	133	41	79·0	3·95	4·55	4,860
April	195	46	95·1	4·75	5·3	5,660
May	450	210	289	14·4	16·6	17,800
June	456	267	298	14·9	16·6	17,700
July	225	117	159	7·95	9·16	9,780
August	404	46	158	7·90	9·11	9,720
September	560	62	169	8·45	9·43	10,060
October	990	30	252	12·6	14·5	15,500
November	990	160	516	27·3	30·5	32,500

NOTE.—Accuracy "B".

Daily Gauge Heights and Discharges of Rainbow creek near Mouth for 1912.

Day.	August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	.....	.....	.....	.....	1·05	74	·95	62
2	.....	.....	.....	.....	.....	.....	.....	81	.....	63
3	.....	.....	.....	.....	.....	.....	.....	88	.....	64
4	.....	.....	.....	.....	.....	.....	.....	95	.....	65
5	.....	.....	.....	.....	.....	.....	.....	102	.....	65
6	.....	.....	.....	.....	.....	.....	.....	109	.....	66
7	.....	.....	.....	.....	.....	.....	.....	116	.....	67
8	.....	.....	.....	.....	.....	.....	.....	123	1·00	67
9	·60	30	.....	.....	.....	.....	.....	129	.....	75
10	.....	.....	.....	.....	.....	.....	1·40	133	.....	83
11	.....	.....	.....	.....	.....	.....	.....	124	.....	91
12	.....	.....	.....	.....	.....	.....	.....	115	.....	99
13	2·50	474	.....	.....	.....	.....	.....	106	.....	107
14	.....	.....	.....	.....	.....	.....	1·20	96	.....	114
15	.....	.....	.....	.....	.....	.....	.....	86	1·35	123
16	·90	56	.....	.....	.....	.....	.....	76	.....	119
17	.....	.....	.....	.....	.....	.....	·90	56	.....	115
18	.....	.....	.....	.....	.....	.....	.....	52	.....	111
19	·90	56	.....	.....	.....	.....	.....	47	.....	107
20	.....	.....	.....	.....	.....	.....	.....	42	.....	103
21	.....	.....	.....	.....	.....	.....	·70	37	.....	99
22	·80	46	.....	.....	.....	.....	.....	36	1·20	96
23	.....	.....	.....	.....	.....	.....	.....	34	.....	103
24	·90	56	.....	.....	.....	.....	·65	33	.....	110
25	.....	.....	.....	.....	.....	.....	.....	37	.....	117
26	.....	.....	.....	.....	.....	.....	.....	41	.....	124
27	.....	.....	.....	.....	.....	.....	.....	45	.....	131
28	.....	.....	.....	.....	.....	.....	.....	49	.....	138
29	.....	.....	.....	.....	.....	.....	.....	53	1·45	144
30	.....	.....	.....	.....	.....	.....	.....	57	.....	151
31	.....	.....	.....	.....	.....	.....	.....	.....	.....	158

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Daily Gauge Heights and Discharges of Rainbow Creek near mouth for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	120	0·7	37	.....	91	.....	55	.....	210	2·45	456
2	.....	110	.....	37	1·2	96	.....	60	.....	225	.....	429
3	.....	100	.....	36	.....	92	.....	65	.....	235	.....	400
4	.....	90	.....	36	.....	88	.....	70	1·85	251	.....	375
5	1·1	81	.....	36	.....	84	.....	75	.....	258	.....	350
6	.....	74	.....	35	.....	80	1·1	81	.....	265	.....	320
7	.....	67	.....	35	.....	76	.....	77	.....	272	.....	295
8	.....	61	.....	34	.....	72	.....	73	.....	279	1·9	267
9	.....	55	0·65	34	1·0	67	.....	68	.....	286	.....	270
10	.....	49	.....	47	.....	75	.....	62	.....	293	.....	272
11	.....	43	.....	60	.....	83	.....	57	2·0	301	.....	275
12	0·7	37	.....	73	.....	91	.....	53	.....	295	.....	277
13	.....	37	.....	86	.....	99	.....	49	.....	290	.....	279
14	.....	37	.....	100	.....	107	0·8	46	.....	285	.....	282
15	.....	36	.....	112	.....	115	.....	55	.....	280	1·95	284
16	.....	36	1·35	123	1·4	133	.....	65	.....	275	.....	281
17	.....	35	.....	115	.....	122	.....	75	.....	270	.....	278
18	.....	35	.....	107	.....	111	.....	85	1·9	267	.....	275
19	0·65	34	.....	99	.....	100	.....	95	.....	289	.....	272
20	.....	37	.....	91	.....	89	1·25	105	.....	311	.....	270
21	.....	40	.....	83	.....	78	.....	112	.....	333	1·9	267
22	.....	43	.....	75	.....	67	.....	119	.....	355	.....	269
23	0·8	46	1·0	56	0·9	56	.....	126	.....	377	.....	271
24	.....	63	.....	71	.....	53	.....	133	2·3	410	.....	273
25	.....	30	.....	75	.....	50	.....	140	2·35	422	.....	275
26	1·2	96	.....	79	.....	48	.....	147	.....	425	.....	277
27	.....	86	.....	83	.....	46	1·5	155	.....	430	.....	279
28	.....	76	.....	87	.....	43	.....	170	.....	435	.....	281
29	.....	66	.....	.....	0·75	41	.....	185	.....	440	1·95	284
30	.....	56	.....	.....	.....	45	.....	195	.....	445	.....	279
31	.....	46	.....	.....	.....	50	.....	.....	.....	450	.....	.....

DAILY GAUGE HEIGHTS AND DISCHARGES of Rainbow Creek near Mouth for 1913—*Concluded.*

Day.	July		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1		255	1·3	113		267		60		160		
2		240		106		339		53		190		
3		225		99		411		47		220		
4		210		92		483		38		250		
5		195		84	2·75	560	0·6	30		270		
6	1·6	180		77		444		165		300		
7		167		69	2·05	318		300		320		
8		153		61		272		435		350		
9		138		54		237		570	2·2	370		
10	1·35	123	0·8	46		202		705		410		
11		130		105		167		840		450		
12		138		155		132	4·0	990		490		
13		146		205		97		820		530		
14		154		255	0·95	62		670		570		
15		160		305		62		520		600		
16	1·55	167		355		62		370	3·0	646		
17		165	2·3	404		62		220		700		
18		162		360		62	1·0	67		750		
19		160		320		62		67		800		
20		157		280		62		65		850		
21	1·5	155		240	0·95	62		63		900		
22		152		200		65		62		950		
23		148		150		68		60	4·0	990		
24		145	1·2	96		71		58		910		
25		141		87		74		56		820		
26		137		78		76		54		730		
27	1·4	133		69		78		52		630		
28		129		60	1·1	81	0·85	51		520		
29		125	0·85	51		74		80		400		
30		120		123		67		110	2·05	318		
31		117		195				140				

RAVEN (RUSHTON) CREEK.

Location.—Below canyon near mouth in section 18, township 5, range 4, west of 7th meridian.

Records Available.—Continuous records from November 3, 1912, to November, 30, 1913.

Winter Conditions.—Open water all season.

Gauge.—Vertical staff gauge. Three readings a week.

Channel.—Permanent rocky channel.

Discharge Measurements.—One measurement in 1912 and four in 1913 show good agreement but do not cover the higher stages.

Accuracy.—The infrequency of the gauge readings and the absence of a flood measurement will tend to impair the accuracy of the work.

RAVEN (RUSHTON) CREEK.

Raven (or Rushton) creek rises in Rushton lake at an elevation of 700 feet, and discharges into Pitt lake on the east side opposite Goose island, at an elevation of about 10 feet. It is part of the Pitt Fraser drainage. The watershed is in the Coast district, with a mean annual precipitation of something like 60 inches. The stream does not freeze over at the mouth, but in the higher altitudes the winter conditions are more severe.

Mr. E. J. Fader, of New Westminster, proposes to develop power on Rushton creek. Rushton lake is 700 feet above Pitt lake and only three quarters of a mile distant. Below the lake there is a fall of about 100 feet high, and only one quarter mile from Pitt lake. The water is to be diverted above the fall and conveyed in a flume and pipeline to the power-house near Pitt lake. Rushton lake could be used for storage. The power is to be used to run a quarry and gravel-screening plant.

A gauging station was established on Rushton creek on November 3, 1912, and gauge readings were taken three times a week for a year. There is a vertical staff gauge just at the lower end of the canyon below the fall, and one quarter mile from Pitt lake. The meter measurements are made by wading at a section 100 feet below the gauge. During the season of 1913 sufficient meter measurements were taken to locate the rating curve.

DISCHARGE MEASUREMENTS of Raven Creek (Rushton) near Mouth 1912 and 1913.

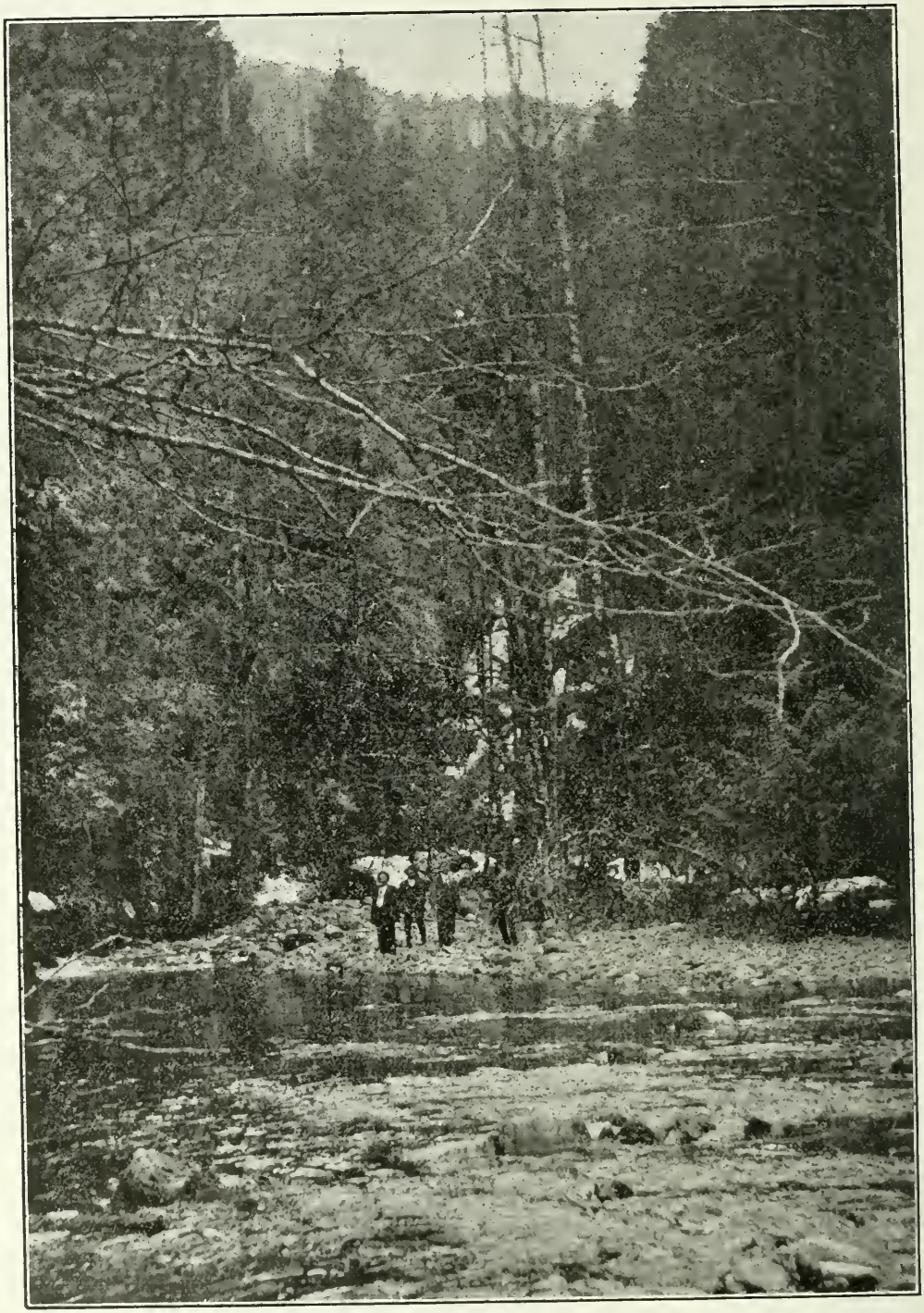
Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height	Discharge
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1912							
Nov. 3	C. G. Cline	1046	32	54	1·2	2·18	63·6
1913							
May 24	C. G. Cline	1044	32	67	2·0	2·57	135·0
July 16	K. G. C. & C. G. C.	1055	30	52	0·9	2·02	46·5
Sept. 17	K. G. Chisholm	1055	15	27	0·8	1·69	20·9
Oct. 26	H. J. E. Keys	1057	30	42	0·6	1·80	25·0

MONTHLY DISCHARGE of Rushton Creek near Mouth for 1912.

Month.	Discharge in Second-Feet.			Run-off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
November	150	17	75	4,469
December	80	19	48	2,957

MONTHLY DISCHARGE of Raven (Rushton) Creek near Mouth for 1913.

Month.	Discharge in Second-Feet.			Run-off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
January	50	5	15·9	977
February	140	13	42·7	2,370
March	120	17	42·3	2,600
April	140	15	56·1	3,340
May	150	31	89·6	5,510
June	160	27	76·4	4,550
July	72	21	40·0	2,640
August	185	7	42·0	2,580
September	620	8	86·1	5,120
October	620	13	120·0	7,380
November	620	21	201·0	12,000



Raven Creek near Metering Station.

Raven Creek—Gravel Deposits at mouth.

Daily Gauge Heights and Discharges of Raven (Rushton) Creek near Mouth for 1912.

Day.	November.		December.	
	Gauge Height.	Discharge	Gauge Height	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1		80	.....	29
2		80	1·9	35
3	2·2	65	...	60
4		85	2·3	80
5	2·4	100	.....	55
6		80	1·85	31
7	2·2	65	..	28
8		55		25
9	2·0	45	1·7	21
10		75	...	20
11	2·4	100	1·65	19
12		125	..	23
13	2·65	150	1·8	27
14		115		35
15	2·3	80		42
16	...	100	2·05	50
17	..	120	....	58
18	2·6	140	2·2	65
19		120		57
20	2·4	100	2·05	50
21	...	85	....	48
22	..	70		46
23	2·05	50	2·0	45
24		38		55
25	1·8	27	2·2	65
26		23		73
27	1·65	19	2·3	80
28		17		75
29	1·55	15		70
30	..	22	2·2	65
31	...	.	.	65

Daily Gauge Heights and Discharges of Raven (Rushton) Creek Canyon near Mouth for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	3·05	50	.....	16	.....	17	.....	55	.....	55	.....	150
2	.....	40	.....	22	.....	22	2·20	65	.....	55	2·70	160
3	1·85	31	1·80	27	1·30	27	.....	60	2·40	100	.....	140
4	.....	26	.....	24	.....	22	2·10	55	.....	85	2·50	120
5	.....	21	1·70	21	1·60	17	.....	50	2·20	65	.....	105
6	1·60	17	.....	18	.....	20	.....	45	.....	55	2·35	90
7	.....	15	1·55	15	1·75	24	1·95	40	.....	45	.....	100
8	1·50	13	.....	16	.....	27	.....	30	1·85	31	.....	110
9	.....	12	.....	16	.....	31	1·70	21	.....	56	2·15	120
10	1·40	10	1·60	17	1·90	35	.....	18	2·30	80	.....	100
11	.....	9	.....	19	.....	31	1·55	15	.....	115	2·30	80
12	.....	8	1·70	21	1·80	27	.....	17	2·65	150	.....	62
13	1·20	7	.....	50	.....	24	.....	19	.....	110	2·00	45
14	.....	7	2·30	80	1·70	21	1·70	21	2·25	72	.....	42
15	1·10	6	.....	100	.....	40	.....	24	.....	80	.....	39
16	.....	5	.....	120	.....	60	1·80	27	2·35	90	1·90	35
17	1·05	5	2·60	140	2·30	80	.....	33	.....	81	.....	47
18	.....	6	.....	110	.....	100	1·95	40	.....	73	2·15	60
19	.....	6	2·30	80	2·50	120	.....	48	2·20	65	.....	90
20	1·20	7	.....	60	.....	100	.....	56	.....	82	2·00	115
21	.....	8	2·00	45	2·30	80	2·20	65	2·40	100	.....	65
22	1·30	8	.....	40	.....	65	.....	78	.....	110	1·80	27
23	.....	15	.....	35	.....	40	2·35	90	.....	120	.....	36
24	1·80	27	1·85	31	1·90	35	.....	100	2·55	130	.....	45
25	.....	26	.....	25	.....	28	2·45	110	.....	120	2·10	55
26	.....	25	1·65	19	1·70	21	.....	125	.....	110	.....	45
27	1·75	24	.....	16	.....	28	2·60	140	.....	100	1·90	35
28	.....	20	1·50	13	1·90	35	2·45	110	.....	90	.....	50
29	1·55	15	.....	.....	.....	38	.....	80	2·30	80	2·25	70
30	.....	12	.....	.....	.....	42	2·00	45	.....	110	.....	55
31	1·40	10	.....	.....	2·00	45	.....	.....	2·60	140	.....	.....

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DAILY GAUGE HEIGHTS AND DISCHARGES of Raven (Rushton) Creek Canyon near Mouth for 1913—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·00	45	1·80	27	2·20	65	1·50	13		21		
2		60		24		345		16	1·70	21		
3	2·25	72	1·70	21	3·90	620	1·65	19		24		
4		60		19		420		16	1·80	27		
5		50		17	3·15	255	1·50	13		77		
6	1·90	35	1·55	15		195		50		127		
7		32		14	2·50	120		90	2·40	100		
8		29	1·50	13		100	2·55	130		200		
9	1·80	27		11		75		365	3·00	225		
10		24	1·30	8	2·05	50	4·80	600		160		
11	1·70	21		13		35		610		100		
12		27		18	1·70	21	4·90	620	2·00	45		
13		33	1·80	27		17		420		43		
14		40		55	1·45	12		200	1·95	40		
15		45	3·30	80		17	2·25	72		220		
16	2·05	50		130		22		62	3·80	390		
17		53	2·30	185	1·80	27		54		280		
18	2·10	55		150		22	2·00	45		170		
19	2·20	65		110	1·60	17		38	2·00	45		
20		55	2·30	80		15		31		50		
21	2·00	45		60	1·50	13		24	2·10	55		
22		40	1·90	35		15	1·60	17		330		
23	1·90	35		30		17		20	4·90	620		
24		29	1·70	21	1·65	19		22		580		
25	1·75	24		19		15		24	4·30	495		
26		30		16	1·30	8	1·80	27		420		
27	1·90	35	1·50	13		10		25	3·60	350		
28		33		10	1·45	12	1·75	24		300		
29		32	1·25	7		12		23		250		
30	1·85	31		27		13		22	2·85	195		
31		29		47			1·70	21				

SILVER HOPE CREEK.

Location.—This stream is measured in two branches, and the results are combined to give the total discharge. The stations are located near the highway bridges near the mouth of the stream in section 5, township 5, range 26, west of 6th meridian.

Records Available.—Continuous records from December 11, 1911, to December 11, 1913.

Winter Conditions.—Open water all season.

Gauge.—Vertical staff gauges—daily readings.

Channel.—Permanent rocky channels, water swift at higher stages.

Discharge Measurements.—Some half a dozen measurements on both branches show a fair agreement and cover most stages of the two branches.

Accuracy.—Fair.

SILVER HOPE CREEK.

Silver Hope creek has its source in the mountains 15 miles south of Hope at an elevation of from two to three thousand feet, and discharges into the Fraser river near Hope at an elevation of about 100 feet. It is part of the Fraser river drainage; the drainage area, as measured from a Dominion sectional map, scale 3 miles to 1 inch, is 80 square miles. The precipitation varies from 50

inches at the mouth to 80 inches or more in the upper section of the watershed, where the winters are severe, with much snow. At present a very small amount of water from this creek is used for irrigation; there is some good land along the Fraser near the mouth of the creek, but with that exception there is little agricultural land in the Silver Creek valley, and none is taken up. The hillsides are very steep, which tends to give a rapid run-off, with small loss by evaporation and seepage. The creek is swift, with many rapids, but the fall is uniformly distributed through its whole length.

The creek is fairly well controlled by Silver lake, about 5 miles from the mouth of the creek, at an altitude of 1,100 feet. The lake has an area of 160 acres, and would afford a suitable reservoir for power development. But this stream is a poor power proposition when compared with others in the same district still undeveloped.

Attempts have been made to build a railroad up the valley, but the grade was found to be too steep. The Pacific highway, however, is now being built through the valley, and will give easy access to this district, which is unrivalled in its primitive beauty.

In establishing a gauging station on Silver Hope creek, it was found most convenient to locate the station at a point where an island divides the creek into two channels. This necessitated the use of two gauges, one on each branch. The sum of the discharges of the two branches represent the total flow of Silver Hope creek. The station was established November 17, 1911, by C. G. Cline, and gauge readings were taken regularly till December, 1913, giving two years records. It is located one half a mile from the mouth, and one quarter of a mile above the C.N.R. bridge. Vertical staff gauges are located on both branches; on the left branch the gauge is fastened to the left abutment of the highway bridge on the upstream side; on the right branch the gauge is fastened to a tree on the right bank 100 feet below the highway bridge. The measuring section on the right branch is 5 feet below the gauge; a tree was felled across the stream, and cable measurements are taken from it. The measuring section on the left branch is at the bridge during high water, when cable measurements are made; during lower water, wading measurements are made 100 feet below the bridge.

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Discharge Measurements of Silver Hope River at Mouth 1911-13

Date.	Hydrographer.	Meter No	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
	Right Branch.						
1911							
Dec. 11	Smith	1057	43	57·1	3·4	2·40	196
1912							
Mar. 1	C. G. Cline	1046	35	74	1·94	1·90	146
June 7	do	1046	46	127	6·02	3·50	765
Sept. 17	do	1046	40	61	1·76	1·73	108
Nov. 19	do	1048	46	134	4·86	3·35	652
Dec. 7	do	1048	40	84	2·37	2·25	199
1913							
May 16	do	1044	46	124	4·54	3·18	563
June 23	do	1044	30	141	6·59	4·00	930
Sept. 10	K. G. Chisholm	1055	30	99	3·28	2·77	324
	Left Branch.						
1911							
Dec. 11	Smith	1057	40	52·2	3·4	1·00	177
1912							
Mar. 1	C. G. Cline	1046	30	55·7	·97	0·55	54
June 7	do	1046	41	82·0	4·1	1·70	335
Sept. 17	do	1046	34	30·5	·83	0·20	25
Nov. 19	do	1048	41	65·1	3·38	1·35	216
Dec. 7	do	1048	39	37	1·16	0·48	43
1913							
May 16	C. G. Cline	1044	45	80	2·68	1·35	214
July 22	K. G. Chisholm	1055	40	75·7	3·62	1·45	275
July 23	"	1044	40	82·5	4·29	1·62	354
Sept. 10	"	1055	52	50·2	1·76	0·71	88
Oct. 14	H. J. E Keys	1057	39	45·7	3·80	1·20	178

Monthly discharge of Silver Hope Creek Island, near mouth, for 1913.

(Drainage Area 80 Square Miles.)

Month.	Discharge in Second-Feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per Square Mile.	Depth in inches on Drainage Area.	Total in Acre-feet.
January	281	124	169·6	2·12	2·44	10,000
February	1,277	126	274·9	3·44	3·58	15,300
March	330	165	213·9	2·67	3·08	13,200
April	910	161	447·1	5·59	6·24	26,600
May	1,950	309	1,049·5	13·1	15·10	64,500
June	3,050	1,155	1,763·5	22·0	24·50	105,000
July	1,555	561	1,048·4	13·1	15·10	64,500
August	621	236	383·6	4·79	5·52	23,600
September	1,390	222	395·4	4·94	5·51	23,500
October	3,000	161	637·9	7·98	9·20	39,200
November	2,375	222	557·7	6·97	7·78	33,100

Note.—Accuracy "A" and "B".

Daily Gauge Heights and Discharges of Silver Hope Creek Island near mouth for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	215	.....	161	.....	184	.....	184	.....	377	.....	2,355
2	.....	215	.....	153	.....	176	.....	168	.....	357	.....	2,675
3	.....	240	.....	150	.....	165	.....	168	.....	333	.....	3,050
4	.....	220	.....	140	.....	165	.....	161	.....	333	.....	2,830
5	.....	192	.....	133	.....	176	.....	172	.....	309	.....	2,030
6	.....	180	.....	132	.....	176	.....	172	.....	333	.....	1,685
7	.....	180	.....	139	.....	200	.....	172	.....	425	.....	1,960
8	.....	180	.....	132	.....	226	.....	172	.....	756	.....	2,080
9	.....	172	.....	129	.....	250	.....	172	.....	1,515	.....	1,850
10	.....	161	.....	126	.....	269	.....	192	.....	1,325	.....	1,535
11	.....	161	.....	126	.....	269	.....	316	.....	1,138	.....	1,575
12	.....	155	.....	126	.....	257	.....	578	.....	1,091	.....	1,645
13	.....	200	.....	126	.....	225	.....	650	.....	1,020	.....	2,080
14	.....	281	.....	126	.....	250	.....	555	.....	874	.....	1,805
15	.....	161	.....	165	.....	220	.....	555	.....	828	.....	1,390
16	.....	153	.....	813	.....	210	.....	495	.....	769	.....	1,390
17	.....	124	.....	1,227	.....	288	.....	515	.....	741	.....	1,280
18	.....	124	.....	744	.....	330	.....	578	.....	701	.....	1,155
19	.....	133	.....	505	.....	276	.....	800	.....	843	.....	1,645
20	.....	135	.....	404	.....	225	.....	800	.....	874	.....	2,295
21	.....	124	.....	356	.....	210	.....	910	.....	874	.....	1,695
22	.....	128	.....	300	.....	210	.....	859	.....	1,138	.....	1,515
23	.....	133	.....	262	.....	200	.....	613	.....	1,747	.....	1,515
24	.....	128	.....	235	.....	196	.....	515	.....	1,950	.....	1,447
25	.....	158	.....	210	.....	184	.....	495	.....	1,927	.....	1,390
26	.....	192	.....	200	.....	184	.....	555	.....	1,815	.....	1,390
27	.....	168	.....	188	.....	184	.....	555	.....	1,950	.....	1,430
28	.....	158	.....	188	.....	184	.....	495	.....	1,657	.....	1,515
29	.....	165	.....	.....	.....	168	.....	439	.....	1,370	.....	1,390
30	.....	161	.....	.....	.....	180	.....	401	.....	1,370	.....	1,390
31	.....	161	.....	.....	.....	196	.....	.....	.....	1,792	.....	.....

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DAILY GAUGE HEIGHTS AND DISCHARGES of Silver Hope Creek Island near mouth for 1913—*Concluded.*

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1		1,447		621		222		212		380		510
2		1,210		621		222		212		339		450
3		1,047		595		222		212		319		410
4		948		561		1,060		212		222		364
5		1,140		507		1,390		202		337		364
6		1,260		497		1,155		178		364		326
7		1,355		457		585		161		380		364
8		1,210		497		448		202		341		337
9		1,140		497		457		226		364		322
10		1,310		404		430		226		464		322
11		1,260		387		404		3,000		410		307
12		1,060		387		340		2,650		364		
13		1,155		370		319		-,105		322		
14		961		348		319		1,270		322		
15		781		390		300		915		304		
16		881		326		281		711		2,375		
17		864		326		269		576		1,180		
18		900		412		326		510		799		
19		1,060		370		286		576		526		
20		1,210		326		269		576		464		
21		1,440		286		252		510		457		
22		1,320		286		319		482		410		
23		1,140		307		300		640		400		
24		1,047		307		257		1,015		845		
25		940		286		240		677		845		
26		830		286		226		510		711		
27		735		257		226		489		711		
28		697		252		252		410		632		
29		864		252		240		380		632		
30		621		236		226		360		510		
31		561		236				337				

SILVER PITT CREEK.

Location.—At lower end of canyon, about 2 miles from mouth of creek, in section 8, township 4, range 5, west of 7th Meridian.

Records Available.—Continuous since August 9, 1912.

Winter Conditions.—Open water all season.

Gauge.—Vertical staff gauge, readings three times a week.

Discharge Measurements.—One measurement in 1912 and five in 1913 show fair agreement.

Accuracy.—Records are not as reliable as though readings had been taken daily.

SILVER PITT CREEK.

Silver Pitt creek rises in the hills between Coquitlam lake and Pitt lake at an elevation of about 3000 feet; and flows from the west into Pitt river near Pitt lake at an elevation of 10 feet. It is part of the Pitt-Fraser drainage. About 3 miles from its mouth the stream flows out through a canyon on to a flat where it has numerous branches and frequently changes its channels. In the last mile of its course it forms a slough in which the water rises and falls with the water in Pitt river under the influence of the tides.

There is a considerable extent of good agricultural land in the flat near the mouth. Much of this land, however, is frequently flooded by the freshets in Silver creek and submerged by the high water in Pitt river. The homesteaders are planning to combine to have the land dyked and drained.

The watershed is in the Coast district, with a mean annual precipitation of about 80 inches. The stream does not freeze over near its mouth in the winter, but near the headwaters the winter conditions are more severe.

The Municipality of Coquitlam is preparing to install a waterworks system which will draw its water supply from this stream near the canyon mentioned above.

A gauging station was established on Silver Pitt creek on August 9, 1912, and gauge readings are being taken about three times a week. The station is at the lower end of the canyon and measures the whole flow of the stream. The gauge is a 6 foot vertical staff nailed to the upstream side of a 16 inch hemlock tree on the left bank of the stream. The meter measurements are made by wading at a section 5 feet above the gauge. A cable has been installed for use in high water. There is a deep pool in the canyon above the station, and there are rapids below.

DISCHARGE MEASUREMENTS of Silver Pitt Creek, Mouth of Canyon 1912-13

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height	Discharge.
1912			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Aug. 9	C. G. Cline	1,046	65	104	2·39	1·50	249
1913							
May 25	C. G. Cline	1,044	60	121	3·05	2·15	369
July 15	K. G. Chisholm	1,055	62·5	100	1·83	1·41	184
Sept. 16	do	1,055	57	68	1·35	0·87	92
Sept. 17	do	1,055	55	66	1·27	0·80	84
Oct. 25	H. J. E. Keys.	1,057	61	73·5	1·60	0·99	116

MONTHLY DISCHARGE of Silver Pitt Creek, Mouth of Canyon for 1913.

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	125	84	94	1·34	1·54	5,780
February	251	51	111	1·57	1·64	6,160
March	175	90	113	1·61	1·86	6,950
April	335	100	250	3·57	3·98	14,900
May	563	278	347	4·96	5·72	21,300
June	428	196	286	4·09	4·56	17,000
July	322	117	221	3·15	3·63	13,600
August	461	45	164	2·32	2·67	10,000
September	884	45	214	3·05	3·41	12,700
October	1,023	45	242	3·46	3·99	14,900
November	973	105	343	4·90	5·47	20,400
December	428	100	223	3·19	3·68	13,700
The year	1,023	45	217	3·10	42·15	157,400

NOTE.—Accuracy "B", "C" and "D".

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Monthly Discharge of Silver Pitt Creek, Mouth of Canyon for 1912.

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
September	262	15	88·1	1·26	1·41	5,240
October	362	35	135·2	1·93	2·22	8,310
November	853	109	322·0	4·59	5·12	19,160
December	285	90	142·5	2·03	2·34	8,730

Note.—Accuracy "B" and "C".

Daily Gauge Heights and Discharges of Silver Pitt River near Mouth of Canyon for 1912.

Day.	August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1				170		105		148		133
2				215	1·1	135		172		145
3			1·7	262		115		200		157
4				237		95	1·5	218	1·3	175
5				218	0·7	70		338	1·0	117
6				197		64	2·4	461	0·9	100
7			1·3	175		58		370		100
8				153		52		270		100
9	1·5	248		131	0·5	45	1·3	175		130
10	1·7	262		100		42		270		160
11	1·4	196	0·8	84		39	2·1	362		190
12	0·8	84		75	0·4	35		607		220
13	0·5	45		66		35	3·6	853		250
14		55	0·6	57		35		620	1·8	285
15		65		52	0·4	35		400	1·25	165
16		75		47		55	1·3	175	1·3	175
17		85		42		75		255	1·1	135
18	0·9	100	0·4	35		95		335		135
19		88		32	1·0	117		415		135
20		76		29		177	2·5	494		135
21	0·6	57	0·3	25		237		461		126
22		52		23		297		424		117
23		47		21	2·1	362	2·1	362		117
24		42		19		342		312	1·0	117
25	0·4	35	0·2	15		322		262	0·85	90
26		35		15	1·9	308		212	1·0	117
27		35		15		258	1·1	135		117
28		35	0·2	15		208	1·0	117		117
29	0·4	35		45		158	0·95	109		117
30		80		75	0·9	100		121		120
31		125				124				120

Daily Gauge Heights and Discharges of Silver Pitt River near Mouth of Canyon for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·05	122	.....	77	.....	102	.....	100	.....	278	.....	412
2	0·9	125	.....	70	.....	110	.....	110	.....	278	2·3	428
3	0·8	100	.....	67	.....	118	.....	120	.....	278	.....	398
4	.....	84	0·65	63	.....	126	1·1	135	.....	278	.....	368
5	.....	84	.....	59	.....	134	.....	165	.....	278	.....	338
6	.....	84	0·55	51	.....	146	.....	195	.....	280	1·9	308
7	.....	84	.....	51	1·2	155	.....	225	1·8	285	1·7	262
8	.....	84	.....	51	1·3	175	.....	255	.....	285	.....	295
9	.....	84	.....	71	.....	165	.....	285	.....	295	.....	328
10	.....	84	.....	91	.....	150	.....	315	.....	305	2·1	362
11	.....	88	.....	101	.....	140	2·0	335	.....	320	.....	335
12	.....	88	.....	121	.....	130	.....	325	.....	340	1·9	308
13	.....	88	.....	141	.....	120	.....	315	.....	365	.....	285
14	.....	88	.....	161	.....	110	.....	365	2·2	395	1·7	262
15	.....	88	.....	181	.....	100	.....	293	2·7	563	.....	273
16	.....	96	.....	201	.....	100	.....	285	.....	503	.....	284
17	.....	96	.....	221	.....	100	.....	277	.....	453	.....	295
18	.....	96	1·65	251	.....	100	.....	270	.....	403	1·9	308
19	.....	96	.....	211	.....	100	1·7	262	2·0	335	.....	285
20	.....	96	.....	171	.....	100	.....	262	.....	343	1·7	262
21	.....	100	.....	131	.....	95	.....	262	.....	351	.....	240
22	.....	100	.....	91	.....	95	.....	262	.....	359	.....	218
23	.....	100	0·75	77	.....	95	.....	262	.....	368	1·4	196
24	.....	100	0·70	70	.....	95	.....	262	2·15	378	.....	218
25	.....	100	.....	70	.....	95	.....	262	.....	364	1·6	240
26	.....	100	.....	78	.....	92	.....	270	.....	350	.....	218
27	.....	100	.....	86	.....	92	.....	270	.....	336	1·4	196
28	0·9	100	.....	94	.....	92	.....	270	.....	332	1·4	196
29	0·8	84	.....	.....	.....	92	.....	270	1·9	308	.....	217
30	.....	84	.....	.....	.....	92	.....	270	.....	351	.....	238
31	.....	84	.....	.....	0·85	90	.....	.....	2·2	395	.....	.....

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Daily Gauge Heights and Discharges of Silver Pitt River near Mouth of Canyon for 1913.

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1		259	1·0	117	1·65	251	0·5	45		105	1·8	285
2	1·8	285		111		567		51	0·95	109		268
3		304		105	3·7	884	0·6	57		113	1·65	251
4	1·95	322	0·9	100		690		54	1·0	117		223
5	1·85	297		92	2·5	495	0·55	51		152	1·4	196
6		303	0·8	84		445		121		197		182
7	1·9	308		77		390		191	1·65	251		168
8		297	0·7	70	2·0	335	1·7	262		230	1·2	155
9	1·8	285		62		287		660		208		136
10		274		54	1·6	240	4·0	959	1·35	186	1·0	117
11		263	0·5	45		195		991		170		111
12	1·65	251		81	1·2	155	4·2	1,023	1·2	155		105
13		229	1·0	117		127		757		145	0·9	100
14	1·45	207		167	0·9	100		493	1·1	135		127
15		184	1·5	218		92	1·55	229		302	1·2	155
16	1·4	196		299	0·8	84		156		469		197
17		218		380		80	0·8	84	2·9	629	1·6	240
18	1·6	240	2·4	461		75		70		392		334
19		225		384	0·7	70	0·6	57	1·2	155	2·3	428
20		210	1·9	308		92		66		140		368
21	1·4	196		263		114		75	1·05	126	1·9	308
22		186	1·5	218	1·1	135	0·8	84		550		286
23	1·3	175		197		113		100	4·05	975		263
24		165		176	0·85	90	1·0	117		894	1·6	240
25	1·2	155	1·2	155		68		114	3·5	821		262
26		149		136	0·5	45		112		708	1·8	285
27		142	1·0	117		49		110	2·8	596		255
28	1·1	135		94		53	0·95	108		505		225
29		126	0·7	70	0·6	57		105		425	1·4	196
30	1·0	117		130		51		102	2·0	335		218
31		117		190			0·9	100			1·6	240

SOUTH LILLOOET RIVER.

Location.—At upper highway bridge, 8 miles from mouth, in section 28, township 12, east of Coast meridian.

Records Available.—Continuous since October 26, 1911.

Winter Conditions.—Open water all season.

Gauge.—Chain gauge on bridge. Gauge readings daily.

Channel.—Permanent rocky channel.

Discharge Measurements.—Two measurements in 1911, four in 1912, and two in 1913 show good agreement and cover practically all stages.

Accuracy.—Good.

SOUTH LILLOOET RIVER.

The South Lillooet river rises in the Lillooet lakes at an elevation of 370 feet, discharging into Pitt river below Pitt lake at about sea-level. The drainage area of the South Lillooet river is 70 square miles, while that of the Lillooet river (including the North Lillooet) is 105 square miles.

The precipitation in the Lillooet watershed varies from 70 inches per annum at the mouth to 80 inches or more at the headwaters. The stream is at present used for logging, but there are water-power possibilities on it.

The original plan of development of this stream by the Burrard Power Company was the diversion of water from the Lillooet lakes over the divide to Kanaka falls near the Fraser river. The Burnett Lumber Company objected

to the alienation of South Lillooet river water, since the company claimed the right to use the natural flow of the stream for logging purposes. From these objections sprung the famous Burrard Power case, through which the right of ownership of the Dominion of Canada to the water within the Railway Belt of British Columbia was formally established.

Another plan of development is by carrying the water in a $5\frac{1}{2}$-mile flume along the hillsides north of the South Lillooet river to a controlling reservoir, and then by a 1500-foot penstock to a power-house in S.E. $\frac{1}{4}$ sec. 28, tp. 12, E. C. M., near the North Lillooet river. This would give a head of something like 300 feet, but the flume would be rather expensive.

The upper Lillooet lake is only about a mile from Stave lake, and is 100 feet higher. A short tunnel would permit the diversion of the water into Stave lake, where it would augment the flow available for the Western Canada Power Company's plant. This company has a head of about 100 feet at its present plant, and could use the water again at the lower plant which it proposes to build to take advantage of the remaining 100-foot drop between the upper plant and tidewater.

There are extensive flats on both sides of the South Lillooet river for 7 miles from the mouth, and part of this land is under cultivation at present. It is often flooded, and much of it must be dyked before it can be used for farming. The land is very fertile, and either open or easily cleared. The intermediate part of the watershed is composed of hills and plateaus a few hundred feet high, with very valuable fir and cedar timber. Some of this has been cut, and logging operations are being carried on at present. The logs are run down the river during the freshets, but this method is not very satisfactory. The building of the proposed Vancouver-Mission tram line will probably provide a better means of handling the timber. In the upper part of the watershed there are mountain peaks several thousand feet high, on some of which the snow remains all summer until washed down by the fall rains.

Near the mouth of the stream the water is deep, sluggish, and is affected by the rise and fall of the tides. Higher up it is swift and comparatively shallow.

The station on the South Lillooet river was established on October 26, 1911, by C. G. Cline, and continuous gauge readings have been taken ever since. It is located at the upper highway bridge across the Lillooet river about $2\frac{1}{2}$ miles from Port Haney, and just south of Yennedon post office. This is about 7 miles above the mouth of the North Lillooet, and 7 miles below Lillooet lake.

The gauge is a chain gauge located near the middle of the bridge on the downstream side—plumber's chain with a plumbbob 24.3 feet long over all. There is also a vertical staff gauge 8 feet long attached to the cribwork of the bridge. Both gauges are referred to the same datum, and three bench-marks are established.

DISCHARGE MEASUREMENTS of South Lillooet River, 8 miles from mouth, 1911–12–13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Oct. 26	C. G. C. & K. H. S.	1,057	100	113	2·0	1·18	226
Dec. 13	K. H. Smith	1,057	120	316	4·3	2·80	1,360
1912.							
July 4	C. G. Cline	1,046	105	151	2·4	1·50	361
Aug. 17	do	1,046	125	288	3·5	2·70	1,010
Sept. 10	do	1,046	115	234	3·3	2·00	767
Nov. 13	do	1,046	125	608	8·1	4·60	4,950
1915.							
May 22	C. G. Cline	1,044	125	266	4·4	2·45	1,180
July 10	K. G. C. & C. G. C.	1,055	125	296	3·8	2·4	1,120

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Monthly Discharge of South Lillooet River, near Mouth for 1913.

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	1,420	220	593	5·93	6·84	36,500
February	5,920	140	1,180	11·80	12·29	65,500
March	2,830	160	693	6·93	7·99	42,600
April	1,420	320	872	8·72	9·73	51,900
May	2,170	440	1,238	12·38	14·30	76,200
June	1,640	840	1,095	10·95	12·18	64,900
July	1,310	320	757	7·57	8·72	46,500
August	750	140	303	3·03	3·49	18,600
September	2,170	120	526	5·26	5·87	31,300
October	4,410	120	1,021	10·21	11·76	63,000
November	5,920	580	2,038	20·38	22·74	121,000
December	1,880	320	900	9·00	10·38	55,300
The year	5,920	120	934	9·34	126·29	673,300

Note.—Accuracy "A", "B" and "D".

Daily Gauge Heights and Discharges of South Lillooet River near mouth for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·7	1,420	1·6	440	1·1	190	1·6	440	1·9	660	2·2	930
2	2·5	1,210	1·6	440	1·1	190	1·5	370	1·8	580	2·8	1,530
3	2·4	1,110	1·6	440	1·0	160	1·5	370	1·7	510	2·9	1,640
4	2·3	1,020	1·5	370	1·0	160	1·4	320	1·7	510	2·9	1,640
5	2·3	1,020	1·5	370	1·2	220	2·0	750	1·6	440	2·8	1,530
6	2·4	1,110	1·5	370	1·4	320	1·9	660	1·6	440	2·4	1,110
7	2·1	840	1·3	270	1·5	370	1·8	580	1·7	510	2·4	1,110
8	1·8	580	1·3	270	1·7	510	1·7	510	2·1	840	2·4	1,110
9	1·7	510	1·2	220	1·7	510	1·7	510	2·3	1,020	2·4	1,110
10	1·7	510	1·1	190	1·7	510	1·0	440	2·8	1,530	2·2	930
11	1·6	440	1·0	160	1·7	510	1·9	660	2·9	1,640	2·1	840
12	1·5	370	1·0	160	1·8	580	2·1	840	3·1	1,880	2·1	840
13	1·4	320	0·9	140	1·6	440	2·3	1,020	2·9	1,640	2·2	930
14	1·6	440	1·2	220	1·6	440	2·4	1,110	3·0	1,760	2·2	930
15	1·7	510	3·5	2,470	1·9	660	2·2	930	3·2	2,020	2·4	1,110
16	1·6	440	4·5	6,660	2·5	1,210	2·1	840	3·3	2,170	2·4	1,110
17	1·5	370	5·0	5,920	3·1	1,880	2·1	840	2·9	1,640	2·2	930
18	1·4	320	4·7	5,170	3·7	2,830	1·9	660	3·0	1,760	2·2	930
19	1·4	320	3·6	2,640	3·3	2,170	2·2	930	2·7	1,420	2·3	1,020
20	1·3	270	3·2	2,020	3·2	2,020	2·5	1,210	2·5	1,210	2·4	1,110
21	1·3	270	3·0	1,760	2·1	340	2·7	1,420	2·4	1,110	2·6	1,310
22	1·4	320	2·5	1,210	1·9	660	2·7	1,420	2·4	1,110	2·6	1,310
23	1·2	220	2·3	1,020	1·7	510	2·6	1,310	2·4	1,110	2·3	1,020
24	1·5	370	1·9	660	1·6	440	2·4	1,110	2·5	1,210	2·2	930
25	1·7	510	1·7	510	1·6	440	2·5	1,210	2·5	1,210	2·2	930
26	1·8	580	1·5	370	1·3	270	2·6	1,310	2·9	1,640	2·1	840
27	1·9	660	1·3	270	1·2	220	2·6	1,310	2·9	1,640	2·1	840
28	1·9	660	1·3	270	1·5	370	2·5	1,210	2·8	1,530	2·2	930
29	1·8	580	.....	.....	2·0	750	2·3	1,020	2·6	1,310	2·2	930
30	1·8	580	.....	.....	1·9	660	2·1	840	2·5	1,210	2·7	1,420
31	1·7	510	.....	.....	1·7	510	.....	.....	2·4	1,110	.....	.....

DAILY GAUGE HEIGHTS AND DISCHARGES of South Lillooet River near mouth for 1913—*Concluded.*

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·6	1,310	1·4	320	1·0	160	1·0	160	1·8	580	3·1	1,880
2	2·6	1,310	1·4	320	1·1	190	1·0	160	1·8	580	3·0	1,760
3	2·5	1,210	1·5	370	1·2	220	0·9	140	1·8	580	2·7	1,420
4	2·4	1,110	1·5	370	1·8	580	0·9	140	1·8	580	2·5	1,210
5	2·4	1,110	1·2	220	3·3	2,170	0·9	140	2·4	1,110	2·3	1,020
6	2·4	1,110	1·0	160	3·0	1,760	0·8	120	2·9	1,640	2·2	930
7	2·3	1,020	1·0	160	2·8	1,530	0·9	140	2·9	1,640	2·2	930
8	2·3	1,020	1·0	160	2·5	1,210	0·9	140	2·7	1,420	2·1	840
9	2·2	930	0·9	140	2·5	1,210	1·0	160	2·5	1,210	2·0	750
10	2·0	750	0·9	140	2·1	840	1·0	160	2·6	1,310	1·8	580
11	2·4	1,110	0·9	140	2·0	750	1·6	440	2·4	1,110	1·9	660
12	2·3	1,020	1·0	160	1·8	580	2·5	1,210	2·2	930	2·0	750
13	2·3	1,020	1·0	160	1·8	580	2·4	1,110	2·0	750	2·0	750
14	2·2	930	1·0	160	1·9	660	.....	2,760	1·9	660	2·1	840
15	2·2	930	1·1	190	1·7	510	4·4	4,410	1·7	510	2·8	1,530
16	2·2	930	1·1	190	1·5	370	3·9	3,230	4·5	4,660	2·0	1,610
17	2·0	750	1·4	320	1·5	370	3·5	2,470	3·8	3·020	2·7	1,420
18	1·8	580	1·9	660	1·4	320	3·1	1,880	3·5	2,470	2·6	1,310
19	1·7	510	2·0	750	1·2	220	2·9	1,640	3·0	1,760	2·3	1,020
20	1·7	510	1·8	580	1·0	160	2·65	1,365	2·7	1,420	2·1	840
21	1·5	370	1·8	580	1·0	160	2·5	1,210	2·6	1,310	2·0	750
22	1·5	370	1·7	510	0·9	140	2·4	1,110	2·5	1,210	1·9	660
23	1·7	510	1·9	660	0·9	140	2·3	1,020	2·5	1,210	1·7	510
24	1·8	580	1·6	440	0·9	140	2·35	975	5·0	5,920	1·6	440
25	1·6	440	1·4	320	0·9	140	2·3	1,020	4·8	5,420	1·5	370
26	1·5	370	1·3	270	0·9	140	2·2	930	4·5	4,650	1·4	320
27	1·4	320	1·2	220	0·8	120	2·1	840	4·4	4,410	1·6	440
28	1·4	320	1·2	220	0·8	120	2·0	750	4·3	4,170	1·8	580
29	1·5	370	1·1	190	0·9	140	1·9	660	3·8	3,020	1·8	580
30	1·5	370	1·0	160	1·0	160	1·8	580	3·1	1,880	1·8	580
31	1·4	320	1·0	160	..	..	1·8	580	..	..	1·8	580

STAVE RIVER.

Stave river rises in Stave lake at an elevation of about 225 feet, and flowing southerly, discharges into Fraser river at Ruskin, at an elevation of 20 feet. It is part of Fraser drainage. Cascade creek flows into Stave river from the east near Stave falls, and McConnell and Cypress creeks flow into Stave Lake also from the east. Glacier and Clearwater creeks enter Stave lake from the west, and the Upper Stave river flows in from the north. This latter stream has not been thoroughly explored, and is visited only by trappers and timber cruisers. It is outside of the Railway Belt, and there are no reliable maps. It is impossible to determine the drainage area accurately, but the engineers of the Western Canada Power Company estimate it at 450 square miles.

The waters of Stave river are being used to develop hydro-electric power which is used in Vancouver, New Westminster, and the surrounding country as far east as Mission.

Precipitation records have been kept at Stave falls by the Western Canada Power Company since October, 1909, and show a mean of about 80 inches. This is probably much less than the average over the whole watershed.

Below the lake the winter conditions are not severe. There are heavy rains at different times of the year, but very little snow or frost, and the river does not freeze over. In the higher altitudes the snowfall is heavy, and there is snow on the mountain peaks practically all summer.

There are a number of glaciers in the watershed. The spring freshets come about May or June, and the run-off is kept large nearly all summer by the melting of the snow on the mountains and glaciers. In the autumn, in October or November, there is generally another flood, caused by the warm autumn rains falling on what is left of the snow. This freshet does not last as long as that in the spring, but is generally more severe. Sometimes also a fall of rain and a few days warm weather in December or January will cause another rise, or winter freshet, of short duration. The low-water periods occur in the autumn near the latter part of August or in September, and in the winter during January, February and March. These statements are, however, only general, and do not always hold true.

Regular gaugings of Stave river have been made by the power company since May, 1905. The first gauge was above the site of the dam, and was flooded out in April, 1910. Since September of that year, a gauging station below the dam has been used. Here there is a good permanent gauge, securely fastened to a heavy timber crib, loaded with rocks, and the gauge has been referred to the regular system of levels used for the construction work. Meter measurements were made from a car suspended from a steel cable, which was stretched across the stream at the gauge. A good rating curve was obtained, particularly at the low and medium stages. Check measurements of discharge were made by the engineers of the Hydrographic Survey. These agree with the power company's rating curve to within 5 per cent. Since the beginning of 1912, stoplogs have been in place in the main dam, and the water of Stave lake has been kept at an artificial level. Hence the discharges of Stave river as recorded by the power company are not the natural flow of the river.

Stave River—Western Canada Power Company. Weir Measurements through Sluice Dam.

Stave lake lies mainly in townships 4 and 5, range 3, west of the 7th meridian. It was originally 9 miles long in a north-and-south direction, and about 1½ miles wide. The east and west shores are almost precipitous, but at the head and foot of the lake there are low-lying areas which are flooded at high water. The lake now makes a good storage reservoir.

Seven miles south of the lake there is a fall in the river, and, including the rapids in the immediate vicinity, there is a total drop of 80 feet. A dam 55 feet high has been constructed, and this is sufficient to drown out the rapids, and to raise the level of the lake about 20 feet. Consequently the reservoir extends from the dam to the upper end of the lake, including the low-lying lands above mentioned. The reservoir is therefore about 16 miles long, and has an area of about 18 square miles.

The total available head is 120 feet, or at the low level of the lake, 100 feet, giving an average head of 110 feet. By means of the storage, a mean flow of at least 3,000 c.f.s. can be obtained. The present power development should produce some 28,000 horse-power continuously, and, under usual operating conditions, a peak load of about 45,000 horse-power.

Below Stave falls, the river continues its course over a series of rapids for a distance of 4 miles, finally debouching through a narrow granite gorge into a tide water basin, where it joins the Fraser river. By the construction of a dam in this gorge a head of 120 feet could be obtained, and the water as it comes from the upper plant could be used to develop a similar quantity of power. In this way the total capacity of Stave river could be used to its best advantage.

The upper Lillooet lake is only about a mile from Stave lake, and is 100 feet higher. A short tunnel would permit the diversion of water into Stave lake, where it would augment the flow available for the Western Canada Power Company. The 100-foot fall from Lillooet lake to Stave lake could probably be utilized also by a plant built near Stave lake below the end of the tunnel.

The present installation at Stave falls includes the dams and spillways necessary to regulate and control the water. The intake and power-house have been placed in an old channel of the river, and this channel has been deepened below the power house, to serve as the tail-race. Machinery has been installed for the development of 26,000 horse-power, consisting of two 13,000 horse-power turbines directly connected to 7,500 kilowatt alternating current generators with the necessary exciters, transformers, switches, etc., and 35 miles of double transmission line (60,000 volts) to the receiving station at Vancouver. Provision has been made for the installation of two more units of 13,000 horse-power each, and it is understood that the company has already ordered some of the additional machinery and equipment.

STAVE RIVER

Location.—Near plant of Western Canada Power Company at Stave falls in section 3, township 4, range 3, west of 7th meridien.

Records Available.—April 19 to December 21, 1901; May 3 to December 31, 1905; January 1 to December 31, 1906; January 1 to December 31, 1907; January 1 to December 31, 1908; January 1 to December 31, 1909; January 1 to April 30, 1910; September 27 to December 31, 1910; January 2 to December 31, 1911; January 1 to December 31, 1912; January 1 to September 30, 1913.

Winter Conditions.—Open water all season.

Gauge.—Vertical staff gauge fastened to rock-filled crib; daily readings; washed out in October 1913.

Channel.—Permanent rocky channel, water swift at higher stages.

Discharge Measurements.—Large number of meter measurements taken from permanent cable station by engineers of the Western Canada Power Company. Three check measurements taken by the engineers of the British Columbia Hydrographic Survey show close agreement. Channel changed in October freshet.

Accuracy.—Good.

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Monthly Discharge of Stave River at Stave Falls for 1913.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
January	3,710	710	1,533	94,100
February	18,400	780	2,999	166,600
March	8,500	810	2,319	142,600
April	7,210	1,800	3,690	219,600
May	11,100	2,190	5,830	358,500
June	10,000	5,650	7,467	443,300
July	11,400	3,810	6,675	410,500
August	8,120	2,440	3,650	224,400
September	31,700	1,760	5,157	307,000

Daily Gauge Heights and Discharges of Stave River near Stave Falls for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1		3,000		1,270		810		2,150		2,190		8,830
2		2,610		1,480		1,270		1,800		2,400		9,670
3		2,290		1,410		2,010		2,010		2,650		10,000
4		1,830		1,200		1,550		2,150		2,820		9,700
5		1,380		990		920		3,850		2,190		7,770
6		1,270		920		2,580		3,320		2,720		6,710
7		1,830		880		2,720		2,650		3,630		6,960
8		1,520		850		2,440		2,300		5,080		7,950
9		1,230		810		2,400		2,120		6,780		6,460
10		1,230		780		2,400		3,530		7,560		5,830
11		1,130		850		2,010		4,700		7,450		5,860
12		810		880		2,330		5,120		7,100		7,000
13		1,130		990		2,120		4,480		7,300		8,050
14		1,730		2,750		1,690		4,130		6,890		7,000
15		920		10,100		1,480		3,880		6,850		8,410
16		1,230		18,400		4,100		2,650		6,140		7,180
17		1,060		15,400		8,500		2,610		4,580		5,900
18		740		5,400		4,420		4,100		5,400		5,650
19		710		3,990		2,820		5,930		6,570		8,330
20		850		3,880		1,940		4,980		5,650		8,760
21		1,230		2,060		1,550		7,210		4,120		7,180
22		710		2,120		1,340		5,300		5,650		7,680
23		1,410		1,520		1,980		3,960		6,360		6,630
24		2,410		1,270		1,550		3,530		6,710		5,970
25		3,710		1,090		1,340		3,810		7,070		6,460
26		2,290		920		1,230		5,470		11,100		6,570
27		1,760		950		2,010		4,940		9,180		6,280
28		1,590		810		1,980		3,530		7,800		8,200
29		1,410				3,460		2,470		7,000		7,170
30		1,310				2,580		2,120		6,320		9,850
31		1,160				2,360				7,530		

DAILY GAUGE HEIGHTS AND DISCHARGES of Stave River near Stave Falls for 1913.—*Concluded.*

DATE.	July.		August.		September.	
	Gauge Height Height	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	11,400	.....	4,620	.....	2,220
2	.....	7,950	.....	4,480	.....	2,290
3	.....	6,880	.....	4,200	.....	15,460
4	.....	6,430	.....	3,880	.....	31,700
5	.....	6,780	.....	3,530	.....	15,950
6	.....	7,800	.....	3,280	.....	9,750
7	.....	9,610	.....	3,180	.....	6,070
8	.....	6,390	.....	3,460	.....	4,840
9	.....	6,530	.....	3,500	.....	6,430
10	.....	8,090	.....	3,390	.....	5,400
11	.....	6,740	.....	3,350	.....	4,310
12	.....	6,610	.....	4,420	.....	3,350
13	.....	5,410	.....	3,430	.....	2,890
14	.....	5,010	.....	3,640	.....	3,070
15	.....	4,200	.....	3,880	.....	2,820
16	.....	4,480	.....	4,060	.....	2,580
17	.....	4,620	.....	4,660	.....	2,470
18	.....	5,300	.....	8,120	.....	2,610
19	.....	6,320	.....	5,360	.....	2,930
20	.....	6,920	.....	4,020	.....	2,580
21	.....	7,030	.....	3,320	.....	2,650
22	.....	6,990	.....	2,860	.....	2,820
23	.....	6,990	.....	3,180	.....	2,650
24	.....	7,060	.....	3,040	.....	2,290
25	.....	7,530	.....	2,860	.....	1,940
26	.....	10,800	.....	2,750	.....	1,760
27	.....	9,820	.....	2,680	.....	2,050
28	.....	5,300	.....	2,650	.....	3,740
29	.....	3,810	.....	2,510	.....	2,650
30	.....	4,310	.....	2,470	.....	2,440
31	.....	3,810	.....	2,440	.....	.....

YOUNG CREEK

Location.—At mouth, in section 10, township 7, range 7, west of 7th meridian.

Records Available.—Continuous since October 20, 1912.

Winter Conditions.—Very heavy snowfall but very little ice in stream; practically open water conditions all season.

Gauge.—Vertical staff gauge, readings once or twice a week.

Channel.—Permanent rocky channel.

Discharge Measurements.—One measurement in 1912 and five in 1913 show fair agreement and cover all stages except the larger freshets.

Accuracy.—Infrequency of gauge readings will tend to impair accuracy of results.

YOUNG CREEK.

Young creek has its source in Young lake at an elevation of 2,200 feet, and discharges into Brandt creek about 2 miles from its mouth, at an elevation of 1,800 feet. It is part of Burrard Inlet drainage.

The rainfall in the Young creek watershed is probably between 120 and 150 inches. There are several feet of snow in the winter, but comparatively little ice, and open-water conditions prevail at the gauging station.

The Westminster Power Company proposes to include Young creek in its high-head development. The latest plan is to divert the water from Young lake through a pipeline to Norton lake, which is to be the main equalizing reservoir. From Young lake the main pipeline will be carried down the hill to the power-house situated near the mouth of Brandt creek. A dam constructed at the outlet of Young lake will provide for considerable storage.

A gauging station has been established by this survey at the mouth of Young creek. The gauge readings so far have been rather irregular. A trail has now been cut from Norton lake to Young lake and it may be found better to discontinue the station at the mouth of Young creek, and establish a new one at Young lake. The erection of a cabin at Norton lake as headquarters for the gauge readers will render this plan more feasible.

DISCHARGE MEASUREMENTS of Young Creek at Mouth 1912 and 1913.

Date.	Hydrographer.	Meter No.	Width	Area of Section.	Mean Velocity.	Gauge Height.	Discharge
1912			Feet.	Sq.-ft.	Ft. per sec.	Feet.	Sec.-ft.
Oct. 20..	C. G. Cline	1,046	10·0	10·8	1·06	2·00	11·41
1913							
June 3	H. C. Hughes	1,673	18·0	21·8	2·46	1·80	53·61
June 10	do	1,673	14·0	15·4	1·95	1·50	30·02
June 18	do	1,673	13·0	16·4	2·26	1·65	37·0
July 30	do	1,673	11·0	7·75	0·80	1·03	6·19
Sept. 18	F. MacLachlan	1,673	10·0	10·8	0·80	1·01	8·61

NOTE.—[1]Old Gauge No. 1 washed out November, 1912.
[2]Gauge No. 2 set December 7, 1912.

Monthly Discharge of Young Creek at Mouth for 1913.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
January	11·5	7·0	8·2	504
February	28·0	8·5	16·6	992
March	25·0	11·5	19·1	1,170
April	53·0	11·5	30·1	1,790
May	140·0	15·0	51·0	3,140
June	53·0	28·0	36·4	2,170
July	35·0	8·0	19·9	1,220
August	13·0	4·0	6·9	424
September	13·0	6·0	8·9	530
October	130·0	5·8	20·6	1,260
November	28·0	10·0	14·0	833
December	13·0	6·0	10·2	627
The year	140·0	4·0	20·2	14,600

Note.—Accuracy "B" and "C".

Monthly Discharge of Young Creek at Mouth for 1912.

Month.	Discharge in Secon -Feet.			Run-Off.
	Maximun.	Minimum.	Mean.	Total in acre-feet.
November	20	11	16·1	958
December	11·5	8	8·87	545

Note.—Accuracy "C."

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Daily Gauge Heights and Discharges of Young Creek near Mouth for 1912.

Day.	October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	.....	16·0	.....	10·0
2	.....	.....	.....	17·0	.....	10·0
3	.....	.....	.....	17·0	.....	9·0
4	.....	.....	.....	18·0	.....	9·0
5	.....	.....	.....	18·0	Gauge	9·0
6	.....	.....	.....	19·0	No. 2.	8·5
7	.....	.....	.....	19·0	1·05	8·5
8	.....	.....	2·2	20·0	.....	9·5
9	.....	.....	.....	20·0	.....	10·5
10	.....	.....	.....	19·0	1·15	11·5
11	.....	.....	.....	19·0	.....	11·0
12	.....	.....	.....	19·0	.....	11·0
13	.....	.....	.....	18·0	.....	9·0
14	.....	.....	.....	18·0	1·15	8·5
15	.....	.....	.....	18·0	.....	8·5
16	.....	.....	.....	17·0	.....	8·5
17	.....	.....	.....	17·0	8·05	.....
18	Gauge	.....	.....	16·0	.....	8·5
19	No. 1.	.....	.....	16·0	.....	8·5
20	2·0	11·4	.....	15·0	.....	8·5
21	.....	11·5	.....	15·0	1·05	8·5
22	.....	12·0	.....	14·0	.....	8·5
23	.....	12·0	.....	14·0	.....	8·5
24	.....	13·0	.....	13·0	1·05	8·5
25	.....	13·0	.....	13·0	.....	8·5
26	.....	14·0	.....	12·0	.....	8·0
27	.....	14·0	.....	12·0	.....	8·0
28	.....	15·0	.....	12·0	.....	8·0
29	.....	15·0	.....	11·0	.....	8·0
30	.....	16·0	.....	11·0	.....	8·0
31	.....	16·0	.....	.....	.....	8·0

Daily Gauge Heights and Discharges of Young Creek at Mouth for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Fect.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	8·0	.....	11	.....	25	.....	11·5	1·25	15	.....	45
2	.....	7·5	.....	11	.....	25	1·15	11·5	.....	15	.....	50
3	.....	7·5	.....	10	.....	25	.....	11·5	.....	16	1·8	53
4	.....	7·5	.....	10	.....	25	.....	12	.....	16	.....	50
5	.....	7 5	1·1	10	.....	25	.....	12	.....	17	.....	46
6	.....	7·5	.....	10	.....	25	.....	13	1·3	17	.....	43
7	.....	7·5	1·1	10	1·45	25	.....	13	.....	50	1·65	40
8	.....	7·0	.....	10	.....	25	1·2	13	.....	80	.....	35
9	.....	7·0	.....	10	.....	24	.....	19	.....	110	.....	30
10	.....	7·0	.....	9	.....	23	.....	24	2·7	140	1·5	28
11	1·0	7·0	.....	9·0	1·4	22	.....	29	.....	120	.....	28
12	.....	7·0	.....	8·5	.....	21	.....	34	.....	100	.....	28
13	.....	7·0	1·05	8·5	.....	19	.....	39	.....	80	.....	28
14	.....	7·0	.....	10·0	1·3	17	1·7	44	.....	62	1·5	28
15	.....	7·0	.....	13·0	.....	18	.....	46	1·7	44	.....	31
16	.....	7·0	.....	16·0	.....	19	.....	48	.....	44	.....	34
17	.....	7·0	.....	19·0	.....	20	.....	51	.....	44	.....	37
18	1·8	7·0	.....	22	.....	21	1·8	53	.....	44	1·65	40
19	.....	7·5	.....	25	1·4	22	.....	50	1·7	44	.....	40
20	.....	7·5	1·5	28	.....	20		48	.....	44	.....	40
21	.....	8·0	.....	28	.....	19	.....	46	.....	44	.....	40
22	.....	8·0	.....	27	1·3	17	1·7	44	.....	44	.....	40
23	.....	8·5	.....	26	.....	16	.....	40	1·7	44	1·65	40
24	.....	9·0	.....	25	.....	14	.....	37	.....	44	.....	34
25	.....	9·5	1·45	25	.....	12	.....	34	.....	45	1·5	28
26	.....	10·0	.....	25	1·15	11·5	.....	30	.....	46	.....	30
27	.....	10·5	.....	25	.....	11·5	.....	27	.....	47	.....	31
28	.....	11·0	.....	25	.....	11·5	.....	24	1·75	48	1·55	32
29	.....	11·0	.....	.....	.....	11·5	.....	21	.....	42	.....	32
30	1·15	11·5	.....	.....	.....	11·5	.....	18	1·6	35	.....	31
31	.....	11·5	.....	.....	.....	11·5	.....	.....	.....	40	.....	.....

DAILY GAUGE HEIGHTS AND DISCHARGES of Young Creek at Mouth for 1913—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1		30		8·5		6·0	1·01	7·3		10		12
2		30	1·05	8·5		7·0		7·3		13		13
3		29		8·0		8·0		7·0		15		13
4		28		7·0		10·0		7·0		17		13
5	1·5	28	0·95	6·0		11·0		7·0		20	1·2	13
6		32		6·0		12·0		7·0		23		13
7	1·6	35		6·0	1·2	13·0		7·0				
8	1·4	22		6·0		13·0		7·0	1·5	28		12
9		22	0·95	6·0		13·0	1·0	7·0		24		12
10		22		6·0		13·0		45·0		20		12
11		22		6·0	1·2	13·0		90·0				11
12	1·4	22		6·0		11·0	2·6	130·0		13		11
13		22		7·0		9·0	1·8	53·0	1·1	10		11
14		21		7·0	1·0	7·0		40·0		10		11
15		21		7·0		7·0		30·0		10		11
16		21	1·0	7·0		7·1	1·25	15·0				10
17		21		9·0		7·2		15·0		10		10
18		20		11·0	1·01	7·3		15·0		10		10
19	1·35	20	1·2	13·0		7·2		14·0		10	1·1	10
20		20		11·0		7·1		14·0		10		10
21		18		9·0		7·0		14·0		11		10
22		16	1·0	7·0		6·9		13·0		11		10
23	1·25	15		7·0	0·99	6·8		13·6		11		9
24		14		6·0		7·0	1·2	13·0		11		9
25		12		5·0		7·0		18·0		11		8
26	1·1	10	0·9	5·0		8·0		10·0		12		7
27		10	0·9	5·0		8·0		9·0		12		7
28		9		5·0		9·0		8·0		12		6
29		8		4·0		10·0		7·0		12		6
30	1·03	8	0·85	4·0	1·1	10·0	0·94	5·8		12	0·95	6
31		8		5·0				8·0				6

MISCELLANEOUS METERING STATIONS.

BELKNAP CREEK BELOW ANN LAKE.

Location.—Section 12, township 7, range 7, west of 7th meridian.

Records Available.—Three meter measurements only.

Winter Conditions.—Very heavy snowfall, but very little ice on the stream. Open water conditions all year.

Gauge.—Gauge painted on big boulder in the stream—no gauge readings.

Channel.—Bed of stream covered with rocks and boulders, giving uneven bottom but good control.

Discharge Measurements.—Three measurements in 1913.

Accuracy.—The three measurements give accurately the discharge on the days they were taken. No gauge readings.

Discharge Measurements of Belknap Creek at Anne Lake, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height	Discharge.
1913			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
June 24	H. C. Hughes	1673	27	76·5	1·76	2·52	135
Aug. 1	H. C. Hughes	1673	32	91·0	0·91	2·08	82·5
Sept. 19	F. MacLachlan	1673	30	59·5	0·50	1·20	29·8

BRIDGE RIVER.

Location.—Near Seton lake, and about 30 miles from the mouth of Bridge river.

Records Available.—One meter measurement. Gauge readings taken regularly since June, 1913, will be available when meter measurements have been made.

Winter Conditions.—Open-water conditions practically all year.

Gauge.—Vertical staff gauge; readings taken twice daily since June, 1913.

Channel.—Sandy, possibility of shifting.

Discharge Measurements.—One measurement.

Accuracy.—Only one meter measurement taken during 1913, but a good set taken during 1914 should give accurate discharge data from the gauge records which have been kept.

BRIDGE RIVER.

Bridge river has its source in the mountains northwest of Lillooet, at an elevation of from 8,000 to 10,000 feet. The stream discharges into the Fraser river 4 miles north of Lillooet at an elevation of 700 feet. It is part of the Fraser drainage.

The south fork enters from the south; and from the north, the north fork, Tyaughton creek and Gun creek. The 1912 provincial map (scale 17.75 miles to 1 inch) shows a drainage area of 2,400 square miles for the whole stream. About 1,900 miles of this is above the gauging station, which is near the site of the intake for the proposed hydro-electric plant.

Probably a small amount of water from the river is used at the various mines. There is a good location for a hydro-electric power development on this stream, as explained below. Water from some of the smaller tributaries is used for irrigation.

The precipitation during the eleven months ending April 30, 1914, was 22 inches. There is snow in the winter, but the cold is not steady and rain is frequent during the winter months. Ice forms in the upper part of the watershed, but the stream is open practically all the year at the gauging station.

The station was established June 13, 1913, by one of the engineers of the Provincial Water Rights Branch, and was taken over by the British Columbia Hydrographic Survey in October, 1913. Gauge readings have been continuous since June 13, 1913.

A number of branches combine about 60 miles northwest of Lillooet to form Bridge river proper. The stream flows through a comparatively narrow valley surrounded by high hills and mountains. About 20 miles from Lillooet it enters a rocky canyon. A few miles above this canyon the stream flows within 5 miles of Seton lake. The elevation of the stream at this point is about 2,800 feet, while the elevation of Seton lake is only 800 feet. This gives a difference in elevation

of some 2,000 feet. The ridge separating the two rises to an altitude of something like 4,000 feet. A wagon road has been built from Mission, at Seton lake, over this ridge to give an entrance into the Bridge River valley. This route was selected in preference to that of the old pack trail which follows up the river from its mouth.

Until the last year or two, comparatively little was heard of the Bridge River country. Some discoveries in mineral, however, created a mild mining boom. A few mines were opened, particularly on Gun creek, and a road was built over the divide, from Seton lake, to replace part of the old pack trail. Some of these mines are being worked at present.

A few ranches have been taken up in the valley above the canyon. Most of these are not very extensive as yet, and probably do not furnish what supplies are necessary for the mines. There is some good land which has not been taken up, but the farming industry will probably never be of very great importance. Near the mouth of the river there are some good benches which produce good crops when irrigated.

On account of the proximity of Bridge river to Seton lake, and the great difference in altitude, there is a splendid chance to develop a large amount of water-power. By driving a tunnel through the intervening ridge, water could be diverted from Bridge river and conveyed to a point on the hillside above Seton lake, whence steel penstocks could be laid to a power-house situated on the lake. Such an installation could make use of the whole minimum flow of Bridge river at a head of about 2,000 feet. If storage could be obtained on Bridge river, the available flow could be increased. The minimum flow of the stream has not been determined as yet, but the measurements given below show that this stream has great power possibilities. For instance, a flow of 1,000 second-feet at a 2,000-foot head would permit a development of more than 150,000 horse-power. The length of the tunnel required, however, will necessitate a large initial development, and before this could be undertaken a market for the power should be assured. The presence of the Pacific Great Eastern railway, which is being constructed along Seton lake, while providing good transportation, introduces certain complications. The diversion of so much water into Seton lake will call for some improvements in Seton creek, which drains the lake, in order to protect the riparian owners. The natural flow of Seton creek is being studied at present by the engineers of this survey.

The gauging station on Bridge river is established at the bridge where the wagon road crosses the river, about 8 miles from Mission and 27 miles from the mouth of Bridge river. There is a staff gauge securely fastened to the timber abutment of the bridge and referenced to three bench-marks. The measurements are made from the upstream side of the bridge, with the meter and weight suspended on a cable. The gauge readings are taken twice a day. A rain gauge is also in use to determine the precipitation.

Discharge Measurements of Bridge River, near Seton Lake, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913			Feet	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Oct. 7	C. G. Cline and H. J. E. Keys	1057	159	1,050	1·8	2·38	1,890

Note.—Station established.

CAPILANO CREEK.

Location.—Just above the Vancouver intake, about 6 miles from the mouth of the creek.

Records Available.—Two meter measurements. Gauge readings since November, 1913, will be available as soon as sufficient meter measurements have been made.

Winter Conditions.—Open water all season.

Gauge.—Vertical staff gauge, readings twice daily.

Channel.—Rocky bed, water swift at high water.

Discharge Measurements.—One meter measurement in 1909 and one in 1913.

Accuracy.—When a good set of meter measurements have been taken and combined with the gauge readings, the results should be quite accurate.

CAPILANO CREEK.

Capilano creek rises in the mountains east of Howe sound, at an elevation of about 2,000 feet, and discharges into Burrard inlet, north of North Vancouver, at sea-level. It has a number of unnamed creeks tributary to it. The drainage area above the Vancouver intake is estimated by the engineers of the Provincial Water Rights Branch at 55 square miles. The stream provides a water supply for the city of Vancouver and the municipality of Point Grey. The precipitation is probably considerably more than 100 inches per annum.

Capilano creek is a swift mountain stream with clear pure water flowing from a well-timbered mountainous watershed. There is no settlement above the intake, and hence no chance for the pollution of the water. On the higher altitudes, and as low as 3,000 feet above sea-level, snow remains in large quantities throughout the whole year. This snow storage plays an important part in regulating the flow of the stream, for the snow melts in the summer and provides a good supply of water at a time when the stream would otherwise be low.

The waterworks intake is some 6 miles from the mouth of the creek. There is a substantial concrete intake fitted with screens, control gates, etc. The water is conveyed in steel pipes down the valley. The pipeline crosses Burrard inlet at the First Narrows and is laid through Stanley park to connect with the city mains. The municipality of Point Grey is to obtain its water supply in a similar manner.

The Capilano valley is quite a resort for tourists, mountain climbers, campers and holiday and outing parties generally. There are two hotels, besides a number of refreshment booths in the summer. One of the North Vancouver car lines runs to the creek, and there are good automobile roads. The natural beauties of the stream and its canyon are a great attraction, and in fine weather large numbers of people visit the various points of interest.

A considerable amount of cedar is cut in the Capilano valley. A lumber chute, several miles in length, has been built, and in this the cedar shingle bolts are sluiced down to Burrard inlet.

A gauging station was established by the British Columbia Hydrographic Survey in November, 1913, to measure the flow of the stream at the waterworks intake. The gauge readings are being taken twice a day. During 1914, sufficient meter measurements will be made to develop a rating curve and so render the gauge readings available. One measurement was made in 1913, giving a flow of approximately 400 cubic feet per second, as shown below

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DISCHARGE MEASUREMENTS of Capilano Creek above city intakes 1909-13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Gauge Height.	Discharge.
1909			Feet.	Sq. ft.	Feet.	Sec.-ft.
Aug. 4	M. Cleveland					318
1913						
Nov. 6	H. J. E. Keys		58	196	0·90	400

CHEAKAMUS RIVER.

Location.—Near mouth of river, and 10 miles north of Squamish (Newport).

Records Available.—One meter measurement only. Regular gauge readings commencing November 29, 1913, will be available when sufficient meter measurements have been made.

Winter Conditions.—Open water all season.

Gauge.—Chain gauge from highway bridge, readings daily.

Channel.—Rocky and permanent.

Discharge Measurements.—One measurement in 1913.

Accuracy.—A good set of meter measurements should give good results with the gauge readings which have been taken.

CHEAKAMUS RIVER.

Cheakamus river rises 40 miles north of Howe sound, near the head of Green river, at an elevation of some 2,500 feet. It discharges into the Squamish river, near Howe sound, at an elevation of about 100 feet, and forms part of the Howe sound drainage. The drainage area of the Cheakamus river, as measured from the provincial map of 1912 (scale 17.75 miles to 1 inch) is about 250 square miles.

The precipitation in the Cheakamus valley is fairly heavy. There is snow in the winter, particularly in the higher altitudes. The small lakes in the headwaters freeze in the winter, but the stream itself remains pretty well open on account of the swiftness of the water.

The route of the Pacific Great Eastern railway follows the Cheakamus river for some 25 miles. For part of this distance the river flows through a rocky canyon, which makes the construction of railroads and trails very difficult and expensive. Above the canyon the valley broadens out, but there is still a great deal of rock in evidence. There is considerable timber in the watershed, but there is not much good farming land.

Between Summit lake and Squamish river, a distance of some 25 miles, there is a total fall of about 1,900 feet. Much of this occurs in the 5 or 6 miles of canyon. The British Columbia Power and Electric Company has applied for the right to divert 1,500 cubic feet of water per second at the canyon for power purposes, but the scheme of development does not seem to be very well defined as yet.

A gauging station was established in November, 1913, by the British Columbia Hydrographic Survey, at the highway bridge near the mouth of the river. It will give the flow of the stream at that point. This is some 5 miles below the canyon, and one or two small creeks enter in that distance. If the flow through the canyon is required, it can probably be determined by applying

a suitable coefficient to the flow as given at the gauging station. A few comparative measurements would determine the value of this coefficient. It would have been difficult to establish a suitable gauging station in the canyon, and almost inpossible to get a regular gauge reader for such a station.

Discharge Measurements of Cheakamus Creek, near Mouth, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Nov. 29.....	H. J. E. Keys.....	1046	75	443	5·97	4·30	2640

GREEN RIVER AT NAIRN FALLS.

Location.—At Nairn falls, about 5 miles from the mouth of Green river and Agerton post office, and about 60 miles up the Pacific Great Eastern railway from Squamish (Newport).

Records Available.—One meter measurement in 1913. Regular gauge readings since November, 1913, can possibly be used when sufficient meter measurements have been made.

Winter Conditions.—Open all year.

Gauge.—Inclined staff gauge fastened by means of holes drilled in the rock. Daily gauge readings.

Channel.—Channel is being changed to quite an extent by railroad constructions along the west bank.

Discharge Measurements.—One meter measurement.

Accuracy.—Results will not be very accurate until the railroad construction is completed.

GREEN RIVER.

Green river has its source in Green lake at an elevation of 2,080 feet. It discharges into Lillooet river near Agerton at an elevation of 700 feet, and forms part of the Harrison-Fraser drainage. Onemile creek, Sixmile creek and Soo river (Eightmile creek) enter from the west.

The drainage areas are measured from the provincial map of 1912 (scale 17·75 miles to 1 inch). The area above the mouth is 200 square miles. Nairn falls are about 5 miles from the mouth of the river, and it is at this point that the gauging station has been established, The area above the falls is about 180 square miles.

The precipitation in the Green River valley is fairly heavy, and there is a moderate snowfall in the winter. Green lake is frozen over for several months but the river being quite swift remains open.

The Green River valley forms part of the route of the Pacific Great Eastern railway, which is to run from Vancouver and Newport, on the coast, through Pemberton Meadows and Lillooet to Fort George. This road follows fairly closely the old pack trail from Howe sound to Pemberton Meadows, and during the construction of the railroad this trail was developed into a road. The completion of the railroad should provide good transportation facilitates in the valley.

At the summit, between Cheakamus river and Green river, there are four lakes, two of which feed Green river. The largest of these, Green lake, is some 4 miles in length. The railroad is being built around the eastern shore, and the

wagon road runs on the west. The locality is quite picturesque, and there is plenty of good fishing and hunting, An enterprising pioneer has established a summer resort on this lake, and expects that it will be well patronized.

Between Green lake and the mouth of the river, a distance of some 17 miles, there is a total fall of 1,400 feet. The stream is very rapid and turbulent. Two important tributaries, Soo river and Sixmile creek, enter below the lake.

About 5 miles from the mouth, the river falls through a narrow rocky gorge, giving a drop of some 170 feet in less than a quarter of a mile. At this point it is proposed to develop hydro-electric power. A small intake dam would provide for the diversion of the water into a short flume and penstock, which would lead to the power-house situated below the falls. This would provide for a head of about 170 feet. There would be very little pondage at the intake. The presence of the railroad a few feet above high water would prevent the full utilization of Green lake storage. The main flow, however, comes from Soo river and Sixmile creek, and it would probably be possible to develop storage on these streams.

Gauging stations were established at Green falls and at Green lake in November, 1913. Stations were established also on the tributaries, Soo river and Sixmile creek, in March, 1914. The station at the falls gives the unregulated flow of the river at the intake site and the other three stations show the distribution of this flow. These stations show the amount of power available with the natural flow of the stream, and also the relative conditions of storage facilities on the tributaries.

Discharge Measurements of Green River, Nairn Falls, 1913.

Date	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Nov. 18..	H. J. E. Keys and C. G. Cline	1,046	84	264	3·4	2·1	918[1]

Note.—[1]Station established.

GREEN RIVER AT GREEN LAKE.

Location.—At outlet of Green lake about 45 miles up the Pacific Great Eastern railway from Squamish (Newport).

Records Available.—One meter measurement in 1913. Regular gauge readings since November, 1913, will be available when sufficient meter measurements have been made.

Winter Conditions.—Lake freezes over, but the stream is open at the gauge.

Gauge.—Vertical staff gauge spiked to stringer of highway bridge; daily gauge readings.

Channel.—Rocky channel..

Discharge Measurements.—One meter measurement.

Accuracy.—Results should be fairly accurate as soon as meter measurements are made.

Discharge Measurements of Green River, at Lake, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Nov. 23	H. J. E. Keys	1,046	26	51·3	3·0	1·32	152[1]

[1]Note.—Station established.

HIXON CREEK ABOVE BELKNAP CREEK.

Location.—Section 36, township 6, range 7, west of 7th meridian.

Records Available.—Three meter measurements during 1913.

Winter Conditions.—Very heavy snowfalls, but little ice in stream. Open water conditions practically all year.

Gauge.—Vertical Staff. No readings.

Channel.—Bed of stream covered with rocks and boulders. Water swift at higher stages.

Discharge Measurements.—Three measurements during 1913.

Accuracy.—Meter measurements good. No gauge readings.

Discharge Measurements of Hixon Creek above mouth of Belknap Creek, Left Fork, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
July 8	H. C. Hughes	1,673	23	31·2	1·34	1·41	42·1
July 31	do	1,673	24	12·8	0·71	1·15	9·8
Sept. 22	F. MacLachlan	1,673	21	12·3	0·49	0·90	6·1

LILLOOET RIVER.

Location.—At highway bridge, near Agerton post office, about 5 miles above Lillooet lake.

Records Available.—One meter measurement only. Regular gauge readings since November, 1913, may be available as soon as sufficient meter measurements have been taken.

Winter Conditions.—The stream was frozen over at the gauging station for part of January and most of February in 1914.

Gauge.—Vertical staff gauge spiked to face of bridge pier. Readings daily.

Channel.—Sandy bed.

Discharge Measurements.—One meter measurement in 1913.

Accuracy.—Possibility of backwater influence from Lillooet lake or of a shifting channel.

LILLOOET RIVER.

Lillooet river rises in the hills north of Jervis inlet at an elevation of from 8,000 to 10,000 feet. It discharges into Harrison lake near Port Douglas at an elevation of 40 feet, and forms part of the Harrison-Fraser drainage.

The tributaries entering from the southwest are: Spring creek, Fire creek, Glacier creek, and Green river. The Birkenhead creek enters from the north. There are also other unnamed tributaries.

The drainage areas are measured from the provincial map of 1912 (scale 17.75 miles to 1 inch). The area above the mouth is 2,200 square miles; above the lower end of Lillooet lake, 1,600 square miles; above the upper end of the lake, 1,300 square miles. The gauging station is situated about 5 miles above the lake, and the drainage area above it is about 800 square miles, or approximately one third of the total drainage.

The precipitation is fairly heavy in the Lillooet valley, and no irrigation is necessary. There is considerable snow and ice above Lillooet lake, and the stream is frozen over for several months in the winter time.

Lillooet river has a total length of about 100 miles. This is divided into approximately two equal parts by Lillooet lake. This lake has a length of about 20 miles and an area of 25 square miles. There is a small settlement at Port Douglas at the mouth of the river, but the more important part of the Lillooet valley lies above Lillooet lake, and is known as Pemberton Meadows.

At one time the lower Lillooet river and lake formed part of the trail to the Cariboo country. At that time Port Douglas was founded and attained considerable importance for a while, since it was at the head of navigation on Harrison lake and river. After the building of the wagon road via Spences Bridge and Ashcroft, of course the Lillooet route was no longer used except locally.

Pemberton Meadows could be reached by one of three routes. There was a pack trail from the head of Howe sound, up the Cheakamus river, across the divide and down Green river; there was a pack trail up Lillooet river from Harrison lake to Lillooet lake; and also a trail from the town of Lillooet and along Seaton and Anderson lakes, which followed down Birkenhead creek. The two former routes give access to the coast, and the latter to the interior. With the projection of the Pacific Great Eastern railway, transportation facilities from the new town of Newport (Squamish) at the head of Howe sound, through Pemberton Meadows to Lillooet were improved, and the trail was finally developed into a wagon road. When the railroad is built by this route it will provide easy access to Pemberton Meadows, and give direct railroad connection between Lillooet and the coast.

At Pemberton Meadows there is quite a block of valuable agricultural land. Good crops are grown at present on the higher ground. Hay and potatoes seem to be the principal products and considerable quantities were grown during 1913 to supply the railway camps. Previous to that time the productions were mainly for local use, on account of the cost of transportation, and more attention was paid to raising cattle and horses. With the completion of the railroad, both these industries will probably be greatly increased.

A great deal of the Pemberton Meadow land is subject to flooding from the Lillooet river. For several miles above Lillooet lake the stream winds through flat meadows, and has very little fall. The silt deposited by the river has built up the banks of the stream above the level of the surrounding meadows. When the stream rises high enough to flood its banks the river spreads out over the farms and prevents the land being worked to the best advantage. A few small dykes have been constructed, but no general scheme of reclamation has as yet been attempted. A project is being considered at present by ranchers and others to control the river and provide for the reclamation of this land. The proposed scheme includes a lowering of the outlet of Lillooet lake and the dredging of the Lillooet river for several miles above the lake, together with the construction of levees along both banks of the river. Partial surveys have been made for this scheme, but no start has been made on the actual construction work.

In connection with this reclamation scheme the British Columbia Hydrographic Survey was requested to make measurements on the Lillooet river to

determine the volume of water which would have to be handled. A station was established at the highway bridge a few miles above Lillooet lake on November 16, 1913. Regular gauge readings are being taken, and a series of meter measurements is to be made so as to give complete records of the stream flow.

DISCHARGE MEASUREMENTS of Lillooet River, near Pemberton Meadows, 1913.

Date.	Hydrographer.	Meter No.	Gauge Height.	Discharge.
1913			Feet.	Sec.-ft.
Nov 16.....	H. J. E. Keys.....	1,046	1·83	1,693

LYNN CREEK.

Location.—Above North Vancouver intake, and about 4 miles from the mouth of the creek.

Records Available.—Meter measurement only. Regular gauge readings have been taken since November 3, 1913, and will be available when sufficient meter measurements have been made.

Winter Conditions.—Open water all season.

Gauge.—Vertical staff gauge.

Channel.—Rocky.

Discharge Measurements.—One meter measurement in 1913; also one by Mr. E. A. Cleveland in 1909, which is not referred to the gauge.

Accuracy.—When sufficient measurements have been made the results should be quite accurate.

LYNN CREEK.

Lynn creek has its source in Lynn lake at an elevation of 2,500 feet, and discharges into Burrard inlet, near North Vancouver, at sea-level. Its drainage area above the North Vancouver intake is estimated by the engineers of the Provincial Water Rights Branch as being about 17 square miles. The stream furnishes the water supply for the municipality of North Vancouver. The precipitation is probably about 100 inches. In the winter time there is snow in the higher altitudes.

Lynn creek watershed lies between the lower portions of the Seymour and Capilano watersheds and directly north of North Vancouver. The watershed is mountainous and well timbered and there is considerable snow storage. The quality of the water is excellent and the streams provide a food supply for North Vancouver during most of the year. It may be necessary to provide storage as the demands of the municipality increase.

A gauging station was established by the British Columbia Hydrographic Survey in November, 1913, to measure the flow of the stream at the intake. Daily gauge readings are being taken. During 1912 sufficient meter measurements will be made to develop a rating curve and so render the gauge readings available. One measurement was made in 1913 giving a flow of 58 cubic feet per second as shown below.

DISCHARGE MEASUREMENTS of Lynn Creek, above City intakes, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1909			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Aug. 4	Mr E. Cleveland						57
1913							
Nov. 3	H. J. E. Keys	1,057	27	28	1·5	1·73	58·5

SEYMOUR CREEK.

Location.—At the Vancouver water works intake, and about 7 miles from the mouth of the creek.

Records Available.—Two measurements in 1909 and one in 1913. Regular gauge readings have been taken since November 6, 1913, and these will be available when sufficient meter measurements have been made.

Winter Conditions.—Open water all year.

Gauge.—Vertical staff gauge—readings daily.

Channel.—Rocky—water swift at higher stages.

Discharge Measurements.—One meter measurement referred to gauge, more to be taken during 1914.

Accuracy.—A good set of measurements should give accurate results.

SEYMOUR CREEK.

Seymour creek has its source in Loch Lomond (Summit lake) at an elevation of 3,300 feet, and discharges into Burrard inlet, near North Vancouver, at sea level. Its more important tributaries are Stoney creek and the East and West Forks. The drainage area above Vancouver intake is estimated by the engineers of the Provincial Water Rights Branch at 76 square miles. The water is used for supplying the city of Vancouver. Below the intake shingle bolts are floated down to Burrard inlet.

The precipitation is probably over 100 inches. In the winter time there are heavy snowfalls in the hills, and snow remains in some places all the year round. The stream does not freeze over at the waterworks intake.

Seymour creek is a swift mountain stream, with clear pure water flowing from a well-timbered mountainous watershed. There is no settlement above the intake, and hence no chance for the pollution of the water. On the higher altitudes, and as low as 3,000 feet above sea-level, snow remains in large quantities throughout the whole year. This snow storage plays an important part in regulating the flow of the stream, for the snow melts in the summer and provides a good supply of water at a time when the stream would otherwise be low. There are places, also, where artificial storage reservoirs could be made.

The waterworks intake is situated some 7 miles from the mouth of the creek. It is a substantial timber structure, fitted with screens and control gates. At the entrance to the pipes there is a settling basin provided with regulating gates and spillways. The pipelines follow the creek valley and cross Burrard inlet there at the Second Narrows.

There is a good road up Seymour creek as far as the waterworks intake. From there, there is a foot trail for several miles farther. People from Vancouver and other places often go camping and mountain climbing in the valley, but strict rules are imposed on all such to prevent contamination of the water supply.

Seymour River—Falls 5 miles from the settlement of Seymour Arm, 35 feet drop.

A gauging station was established in November, 1913, by the British Columbia Hydrographic Survey at the waterworks intake, and regular records of the flow of the stream are being kept. The gauge is a vertical staff attached to the face of the timber cribbing just above the intake opening. Meter measurements are made from a light cable equipment, some 200 feet above the gauge. At low water, measurements are made by wading. During 1914 sufficient measurements will be made to develop a rating curve and render the gauge readings available. In the meantime the meter measurements already taken are listed below.

DISCHARGE MEASUREMENTS of Seymour Creek, above City intakes, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1909			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Aug. 4	M. Cleveland						367
Aug. 16	do						21
1913							
Nov. 6	H. J. E. Keys		67	133		2·60	282

SLOLLICUM CREEK.

Location.—Near mouth of stream below falls near Harrison lake in section 19, township 5, range 28, west of 6th meridian.

Records Available.—One meter measurement only.

Winter Conditions,—Open water all year.

Gauge.—No gauge.

Channel.—Rocks and gravel.

Discharge Measurements.—One measurement not referred to any gauge.

Accuracy.—The meter measurement merely gives the discharge on the day it was made and is of course quite accurate for such a purpose.

SLOLLICUM CREEK.

Slollicum creek rises near the base of Slollicum mountain on the east side of Harrison lake at an elevation of some 2,050 feet. It discharges into Cascade bay, an arm of Harrison lake, at about 40 feet above sea-level. It is part of the Harrison-Fraser drainage. There is a small lake on one of the branches of the creek.

The rainfall in the Slollicum creek watershed will be considerably greater than that given by the meteorological station at Agassiz. The mean annual rainfall at Agassiz is 67 inches, so that probably at Slollicum creek there would be from 75 to 100 inches, depending on the altitude. In the winter there is quite a heavy snowfall, and the stream freezes over in the upper part of the watershed. Near the mouth, however, the falls keep the stream open, though masses of ice are formed by the spray.

Near the mouth of the stream there is a series of very high falls, the largest of which has a drop of nearly 200 feet, and the total fall in less than half a mile is 2,000 feet. The stream is quite small, but a considerable amount of power could be developed quite cheaply on account of the high head. A meter measurement taken on September 17, 1913, gives a discharge of 20 cubic feet per second.

The minimum flow may be slightly less than this amount, but with a small amount of storage, probably a mean flow of 20 c.f.s. could be maintained. At 2,000 feet this would give some 16,000 horsepower.

Slollicum creek is only 6 miles from Harrison Hot Springs and the St. Alice hotel. The falls are quite an attraction to the guests at the hotel, and it is a fine trip across the lake by motor launch.

Discharge Measurements of Slollicum Creek, at Mouth, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft
Sept. 17	K. G. Chisholm	1,055	14	12·6	1·55	.....	20

REPORT

OF

BRITISH COLUMBIA HYDROGRAPHIC SURVEY FOR 1913

CHAPTER 6

Kamloops Division—Hydrographic Data

CHAPTER VI.

KAMLOOPS DIVISION.

REGULAR METERING STATIONS.

ADAMS RIVER.

Location.—Section 6, township 23, range 12, west 6th meridian.

Records Available.—1st July to August 31 1911; 1st January to December 31, 1912; 1st January to December 31, 1913.

Winter Conditions.—Partial ice conditions exist during winter months, but river is seldom frozen over at the gauge sufficiently to have a material effect on the accuracy of returns. Severe spells of cold weather are generally of short duration.

Gauge.—A vertical staff gauge read daily by Mrs. Sturgill. On account of sluicing operations of the Adams River Lumber Company, sudden changes of gauge height due to the opening or closing of the storage dam on Adams lake probably escape the observer's notice, and consequently gauge readings may be slightly inaccurate.

Channel.—The channel varies in width from 300 to 500 feet above the dam, where meterings are made. The velocities are uniform, the mean never exceeding 3.0 feet per second at the measuring section. The run-off is artificially controlled by a dam near the outlet of Adam's lake.

Discharge Measurements.—The gauge-height-discharge curve is rated by well distributed meterings.

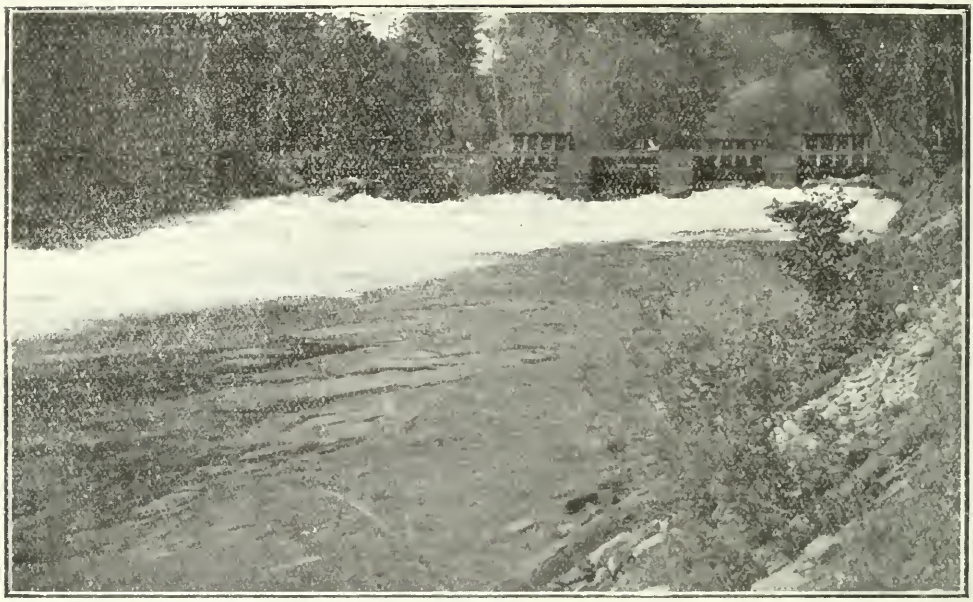
Accuracy.—The accuracy of results attached would be very high if gauge readings could be relied upon. As pointed out above, this is an uncertain source of error. It is probable, however, that results given are for the most part within 10 per cent of the truth.

It is proposed to instal a self-recording gauge at this station during 1914 to obviate possible difficulty from the source referred to above.

ADAMS RIVER.

Adams river has its source in Adams lake, at an elevation of 1340 feet and, flowing in a southerly direction, discharges into Shuswap lake near the town of Chase, at an elevation of 1,153 feet. The following tributaries enter from the west, going upstream: Bear creek, Bush creek, Pass creek, and upper Adams river; Nikwikwaia creek enters from the east. Adams river is a part of the Shuswap lake-Thompson river drainage. The drainage area, as measured from a provincial map, scale 20 miles to 1 inch, is 1,700 square miles; of this area, Adams lake constitutes 60 square miles. The water is used extensively for logging by the Adams River Lumber Company.

The Upper Adams river rises in Tum-Tum lake about 80 miles north of the main line of the C.P.R. near Chase. From this lake it flows in a southerly direction for about 40 miles into Adams lake, a magnificent sheet of water, 40 miles long, a mile and a half wide, surrounded by high mountains. The lake rises 4 to 5 feet above its low-water level, high water taking place in June. There



Adams River—Adams River Lumber Company's Dam below Adams Lake.

is some agricultural land around the lake, but it is sparsely settled, and if it were desirable to use the lake as a storage reservoir for water-power purposes, and retain the lake at its high-water level, no important interests would be affected. At its southerly end, Adams lake empties into Adams river, where it falls 190 feet into Shuswap lake in the short distance of 6 miles.

There are large areas of valuable timber along Adams lake and its several tributaries. The Adams River Lumber Company is the largest operating company. This company has constructed a dam on Adams river, about one quarter of a mile from the outlet of the lake, for log driving purposes. The dam is rock-filled, timber-cribbed, about 180 feet long and 15 feet high; it has six sluice-gates, and a fish ladder.

On account of the excellent storage of Adams lake, it will be easy to conserve the greater part, if not all, of the run-off from season to season. The total discharge of 1912 will give a good daily mean for that period; the year 1912, however, is above the normal in run-off in this locality, and so should not be taken as representative of an average year.

The Adams River station was established June 31, 1911, by C. E. Richardson. The measuring section is located 250 yards above the Adams River Lumber Company dam, and 25 yards above the old wing dam. The gauge is a vertical staff gauge (fir) 2 inches by 4 inches by 8 feet marked in feet and tenths with black paint. It is fastened to a rock-filled crib, 7 feet high, which was built to protect the gauge from logs and ice. The crib is situated in a back-eddy on the right bank, 75 yards, below the dam. The measurements are made by means of the following equipment: a $\frac{3}{8}$-inch mild steel cable is stretched across the river, 20 feet down stream a tag line of $\frac{1}{8}$-inch mild steel cable is stretched across and pulled taut. A boat is fastened by rope to the larger cable, and allowed to rest directly below the tag line. Measurements are made every 20 feet.

This is an excellent measuring section; there is only one channel, with a permanent bed; the banks are good and the current is even. The datum of the gauge is referred to three bench-marks.

SESSIONAL PAPER No. 25f

Monthly Discharge of Adams River below Adams Lake for 1913.

(Drainage area, 1,700 square miles).

Month.	Discharge in Second-Feet				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area	Total in acre-feet.
January	175	160	160	0·09	0·10	9,838
February	169	160	160	0·09	0·09	8,885
March	2,290	160	658	0·39	0·45	40,459
April	2,400	160	1,521	0·89	0·99	90,510
May	8,300	2,290	3,484	2·05	2·36	214,220
June	13,890	1,400	9,710	5·71	6·37	577,790
July	5,900	1,050	5,039	2·96	3·41	309,849
August	10,300	1,050	3,406	2·00	2·31	209,420
September	4,490	910	3,309	1·95	2·18	196,940
October	1,270	885	1,009	0·59	0·68	62,040
November	2,870	1,350	1,932	1·14	1·27	114,960
December	1,970	250	823	0·48	0·55	50,666
The year	13,890	160	2,601	1·53	20·76	1,885,528

Daily Gauge Heights and Discharges of Adams River below Adams Lake for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	−0·2	175	−0·3	160	−0·3	160	3·0	2,290	5·3	2,700	4·9	8,300
2	−0·3	160	−0·3	160	−0·3	160	3·0	2,290	3·2	2,540	4·9	8,300
3	−0·3	160	−0·3	160	−0·3	160	3·0	2,290	3·2	2,540	5·0	8,800
4	−0·3	160	−0·3	160	−0·3	160	3·1	2,400	3·1	2,400	5·1	9,300
5	−0·3	160	−0·3	160	−0·3	160	3·1	2,400	3·1	2,400	5·2	9,800
6	−0·3	160	−0·3	160	−0·3	160	3·1	2,400	3·0	2,290	5·3	10,300
7	−0·3	160	−0·3	160	−0·3	160	3·1	2,400	3·0	2,290	5·3	10,300
8	−0·3	160	−0·3	160	−0·3	160	−0·3	160	3·0	2,290	5·4	10,800
9	−0·3	160	−0·3	160	−0·3	160	−0·3	160	3·0	2,290	5·4	10,800
10	−0·3	160	−0·3	160	−0·3	160	−0·3	160	3·0	2,290	5·5	11,300
11	−0·3	160	−0·3	160	−0·3	160	−0·3	160	3·1	2,400	5·6	11,800
12	−0·3	160	−0·3	160	−0·3	160	−0·3	160	3·1	2,400	5·6	11,800
13	−0·3	160	−0·3	160	−0·3	160	−0·2	175	3·2	2,540	5·7	12,300
14	−0·3	160	−0·3	160	−0·3	160	−0·2	175	3·2	2,540	5·8	12,800
15	−0·3	160	−0·3	160	2·7	1,970	−0·2	175	3·3	2,700	5·8	12,800
16	−0·3	160	−0·3	160	2·7	1,970	−0·2	175	3·4	2,870	5·8	12,800
17	−0·3	160	−0·3	160	2·7	1,970	−0·2	175	3·5	3,070	5·9	13,300
18	−0·3	160	−0·3	160	2·7	1,970	−0·2	175	3·5	3,070	5·9	13,300
19	−0·3	160	−0·3	160	2·7	1,970	−0·2	175	3·6	3,290	5·9	13,300
20	−0·3	160	−0·3	160	−0·3	160	−0·2	175	3·8	3,290	6·0	13,800
21	−0·3	160	−0·3	160	−0·3	160	−0·2	175	3·6	3,290	6·0	13,800
22	−0·3	160	−0·3	160	−0·3	160	−0·2	175	3·8	3,770	5·9	13,300
23	−0·3	160	−0·3	160	−0·3	160	3·7	3,520	3·8	3,770	4·2	5,120
24	−0·3	160	−0·3	160	−0·3	160	3·7	3,520	3·8	3,770	4·2	5,120
25	−0·3	160	−0·3	160	−0·3	160	3·7	3,520	3·9	4,080	4·1	4,750
26	−0·3	160	−0·3	160	−0·3	160	3·7	3,520	3·9	4,080	4·0	4,400
27	−0·3	160	−0·3	160	−0·3	160	3·6	3,290	4·0	4,400	4·0	4,400
28	−0·3	160	−0·3	160	−0·3	160	3·6	3,290	4·1	4,750	4·0	4,400
29	−0·3	160			3·0	2,290	3·5	3,070	4·8	7,800		
30	−0·3	160			3·0	2,290	5·4	2,870	4·8	7,800		
31	−0·3	160			3·0	2,290			4·9	8,300		

DAILY GAUGE HEIGHTS AND DISCHARGES of Adams River below Adams Lake for 1913—*Concluded.*

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			1·6	1,050	3·8	3,770		1,270		1,435	2·7	1,970
2			1·6	1,050	3·8	3,770		1,270		1,435	2·7	1,970
3			1·7	1,120	3·4	2,870		1,200		1,435	2·7	1,970
4			1·7	1,120	3·8	3,770		1,200		1,435	2·6	1,870
5			5·3	10,300	3·8	3,770		1,200		1,350	2·6	1,870
6			5·3	10,300	3·65	3,405		1,145		1,350	2·6	1,870
7			1·7	1,120	3·5	3,070		1,145		1,350	2·5	1,770
8			1·9	1,270	4·0	4,400		1,145		1,350	2·5	1,770
9			1·9	1,270	3·9	4,080		1,090		1,350	2·4	1,670
10			1·9	1,270	3·9	4,080		1,090		1,645	2·4	1,670
11		5,000	1·9	1,270	3·9	4,080		1,035		1,645	0·1	250
12		sec.-ft.	2·0	1,345	3·8	3,770		985		1,535	0·1	250
13		probab-	2·0	1,345	3·8	3,770		985		1,535	0·1	250
14		ly	2·0	1,345	3·75	3,645		935		1,535	0·1	250
15		mean	2·0	1,345	3·75	3,645		935		1,535	0·1	250
16		this	2·0	1,345	3·7	3,520		935		1,535	0·1	250
17		period.	3·8	3,770	3·7	3,520		935	3·4	2,870	0·1	250
18			3·8	3,770	3·7	3,520		935	3·4	2,870	0·1	250
19			4·3	5,520	3·7	3,520		935	3·4	2,870	0·1	250
20		5,900	4·3	5,520	2·55	1,829		885	3·4	2,870	0·2	280
21		5,650	3·7	3,520	1·40	910		885	3·3	2,700	0·2	280
22		5,650	3·7	3,520	3·6	3,290		885	3·3	2,700	0·2	280
23		5,650	3·7	3,520		3,000		885	3·3	2,700	0·2	280
24		5,650	4·5	5,520		3,000		885	2·9	2,180	0·2	280
25		5,400	4·3	5,520		3,000		885	2·9	2,180	0·2	280
26		5,400	4·2	5,120		3,000		935	2·9	2,180	0·2	280
27		5,400	4·2	5,120		3,000		935	2·9	2,180	0·2	280
28		5,150	4·1	4,750	3·4	2,870		935	2·8	2,070	0·2	280
29		5,150	4·0	4,400	3·5	2,700		935	2·8	2,070	0·2	280
30		5,150	3·9	4,080	3·3	2,700		935	2·8	2,070	1·6	1,050
31	1·6	1,050	3·9	4,080				935				1,050

BARNES CREEK, NEAR ASHCROFT.

Location of Station.—Section 11, township 20, range 24, west 6th meridian, about 5 miles southeast of Ashcroft, and just above Barnes lake.

Records Available.—April 26, 1912, to September 14, 1912; May 1, 1913, to December 14, 1913.

Winter Conditions.—Light snowfall and short periods of severe cold.

Gauge.—Vertical staff gauge 5 feet in height, referred to bench-marks. Gauge readings have been taken daily during the irrigation season by John Smith, Ashcroft.

Channel.—The stream is straight for about 100 feet above the measuring section and for 50 feet below it. The water is swift and is well confined by the bridge approaches.

Discharge Measurements.—Measurements are made by wading at the downstream side of the traffic bridge.

Accuracy.—Results as shown are accurate, as fair conditions for metering and gauge readings existed.

BARNES CREEK.

Barnes creek (sometimes called Pennies or Penneys creek) has its source in the hills east of Ashcroft, at an elevation of 4,000 feet. It discharges into the Thompson river from the south, 4 miles east of Ashcroft, at an elevation of 960 feet, and is part of the Thompson River drainage. The drainage area

above the mouth is 38 square miles, and above the gauging station it is 35 square miles. The water is used for irrigation. It is a contentious stream, almost drying up in July and August. It lies in the dry belt, with a mean annual precipitation of about 9 inches. The summers are hot and dry, and the winters cold and dry.

Barnes creek is about 12 miles long, about 12 feet wide, and its depth varies from 0·5 foot at low water to 1·7 foot at high water. Its mean velocity at high water is 3·5 feet per second.

The discharge fluctuates from practically zero in the winter to a maximum of about 50 or 60 cubic feet per second in the spring freshet during the middle of May. Then it declines rapidly until it becomes as low as from 3 to 4 second-feet about July 1, and all through the month. In the fall it rises for a short time, then recedes as winter and the cold weather comes in.

Water is diverted from Barnes creek near the headwaters, and is stored in the Twin lakes for use, near Walhachin. There is another diversion to Barnes lake. From Barnes lake the water may be returned to Barnes creek, for use farther down the stream, or it may be run into Nelson creek for use in that direction. Usually there is a shortage of water on Barnes creek. But in 1912 Barnes lake filled and over-flowed and the water users were forced to ask that water be diverted to Twin lakes, though they had previously taken out an injunction against it.

The gauging station on Barnes creek is 200 yards above Barnes lake and 5 miles southeast of Ashcroft, B.C. It was established April 26, 1912, by C.G. Cline, and daily gauge readings were taken till the end of the irrigation season. The gauge is situated 150 feet above the first highway bridge over the main stream above Barnes lake. It is a 5-foot staff gauge nailed to a small tree on the right bank of the creek. The measurements were made by wading at the downstream side of the bridge. The stream is straight for about 100 feet above the measuring section, and for 50 feet below it. The water is swift. The road has been built up to form the approaches to the bridge, and there is no danger of overflow. There is only one channel, which is about 6 inches deep at ordinary low water. The river just below the gauge should be examined occasionally to see that brush and logs do not collect on it and so back the water up on the gauge. This station gives the whole flow of the stream except what is diverted into the Twin lakes, near the headwaters of the stream, by the British Columbia Horticultural Estates of Walhachin.

MONTHLY DISCHARGE of Barnes Creek above Barnes Lake, for 1913.

(Drainage area, 38 square miles.)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum.	Minimum.	Mean	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet
May	2[illegible]	4	13·2	0·35	0·40	812
June	44	5	16·8	0·41	0·49	1,100
July	35	2	12·3	0·35	0·40	818
August	19	2	5·7	0·15	0·17	350
September	4	2	2·4	0·06	0·07	143
October	4	3	3·6	0·10	0·11	211
November	4	3	3·4	0·09	0·10	202
December	..	..	..	..	..	250
						Estimated

Discharge Measurements of Barnes Creek above Barnes lake, for 1913.

Date	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 2	K. G. Chisholm	1,055	10	5·0	1·05	0·43	5·3
June 13	do	1,055	9	4·95	1·16	0·45	5·7
Aug. 14	do	1,055	7·5	3·75	1·09	0·40	4·1

Daily Gauge Heights and Discharges of Barnes Creek above Barnes lake, for 1913.

Day.	May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	5	0·6	12
2	0·45	5	0·6	12
3	0·4	4	0·6	12
4	0·4	4	0·55	10
5	0·4	4	0·55	10
6	0·45	5	0·5	7
7	0·4	4	0·5	7
8	0·4	4	0·5	7
9	0·6	12	0·5	7
10	0·7	19	0·5	7
11	0·65	15	0·5	7
12	0·6	12	0·45	5
13	0·6	12	0·45	5
14	0·55	10	·45	5
15	0·6	12	0·45	5
16	0·6	12	0·6	12
17	0·6	12	0·6	12
18	0·65	15	0·55	10
19	0·65	15	0·55	10
20	0·75	23	0·55	10
21	0·7	19	0·55	10
22	0·75	23	0·75	23
23	0·75	23	1·00	44
24	0·75	23	0·95	40
25	0·7	19	0·95	40
26	0·7	19	0·9	35
27	0·7	19	0·9	35
28	0·7	19	0·9	35
29	0·65	15	0·9	35
30	0·65	15	0·9	35
31	0·6	12	.....	.....

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DAILY GAUGE HEIGHTS AND DISCHARGES of Barnes Creek above Barnes lake, for 1913—*Concluded.*

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	0·9	35	0·3	2	0·3	2	0·35	3	0·4	4	0·35	3
2	0·85	31	0·3	2	0·3	2	0·35	3	0·4	4	0·4	4
3	0·8	27	0·3	2	0·3	2	0·35	3	0·4	4	0·4	4
4	0·8	27	0·3	2	0·3	2	0·35	3	0·4	4	0·4	4
5	0·75	23	0·3	2	0·3	2	0·35	3	0·4	4	0·4	4
6	0·75	23	0·3	2	0·3	2	0·35	3	0·4	4	0·4	4
7	0·7	19	0·3	2	0·3	2	0·35	3	0·4	4	0·4	4
8	0·7	19	0·3	2	0·3	2	0·35	3	0·4	4	0·4	4
9	0·6	12	0·3	2	0·3	2	0·35	3	0·4	4	0·4	4
10	0·6	12	0·3	2	0·3	2	0·35	3	0·4	4	0·4	4
11	0·7	19	0·3	2	0·3	2	0·35	3	0·4	4	0·4	4
12	0·7	19	0·35	3	0·3	2	0·4	4	0·4	4	0·4	4
13	0·7	19	0·4	4	0·3	2	0·4	4	0·4	4	0·4	4
14	0·65	15	0·4	4	0·3	2	0·4	4	0·35	3	0·4	4
15	0·65	15	0·4	4	0·3	2	0·4	4	0·35	3		
16	0·65	15	0·4	4	0·3	2	0·4	4	0·35	3		
17	0·6	12	0·6	12	0·3	2	0·4	4	0·35	3		
18	0·6	12	0·7	19	0·3	2	0·4	4	0·35	3		
19	0·55	10	0·7	19	0·3	2	0·4	4	0·35	3		
20	0·5	7	0·65	15	0·3	2	0·4	4	0·35	3		
21	0·5	7	0·6	12	0·3	2	0·4	4	0·35	3		
22	0·4	4	0·6	12	0·4	4	0·4	4	0·35	3		
23	0·4	4	0·55	10	0·4	4	0·4	4	0·35	3		
24	0·4	4	0·55	10	0·4	4	0·4	4	0·35	3		
25	0·4	4	0·5	7	0·4	4	0·35	3	0·35	3		
26	0·4	4	0·45	5	0·35	3	0·4	4	0·35	3		
27	0·4	4	0·4	4	0·35	3	0·4	4	0·35	3		
28	0·4	4	0·4	4	0·35	3	0·4	4	0·35	3		
29	0·3	2	0·35	3	0·35	3	0·4	4	0·35	3		
30	0·3	2	0·3	2	0·35	3	0·4	4				
31	0·3	2	0·3	2	0·35		0·4	4				

BOLEAN CREEK.

Location.—Section 9, township 18, range 12, west 6th Meridian.

Records Available.—May 23 to December 31, 1911; January 1 to September 16, 1912; April 27 to September 19, 1913.

Winter Conditions.—Not very severe. Stream sometimes remains practically open all winter.

Gauge.—Vertical staff gauge read daily by Clement Stickney.

Channel.—The bed is of sand and gravel, the channel being about 25 feet in width. Flow varies from a recorded minimum of 6 second-feet (March 16, 1912) to a maximum of 412 second-feet (May 16 1912.)

Discharge Measurements.—Nine discharge measurements have been made, but the curve is not very well defined.

Accuracy.—Accuracy of results appended is low, but they are probably within 15 per cent of obtaining conditions.

Discharge Measurements of Bolean Creek, near Slahaltkan, for 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 23	W. M. Carlyle	1,044	24	58·5	3·15	2·2	183
June 16	do	1,044	24	48·4	2·63	1·95	127
July 12	do	1,044	23	34·6	2·5	1·81	87
" 26	do	1,044	17	15·1	1·34	1·24	[1]20·3
Aug. 2	do	1,044	16	11·8	0·86	1·02	10·1
1912.							
May 13	C. E. Richardson	1,048	25	61·2	4·3	2·55	262·9
July 16	do	1,048	23	518·9	1·66	1·39	31·4
1913.							
April 23	H. J. E. Keys	1,057	21	27·1	2·10	1·68	57
June 18	do	1,057	28	29·3	2·80	2·10	82

Note.—[1] New section.

Monthly Discharge of Bolean Creek River near Slahaltkan for 1913.

(Drainage area, 80 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	292	30	161	2·02	2·33	9,900
June	272	93	151	1·89	2·11	8,980
July	179	26	67	0·84	0·97	4,120
August	39	14	24	0·30	0·35	1,480

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Daily Gauge Heights and Discharges of Bolean Creek near Slahaltkan for 1913.

Day.	April.		May.		June.	
	Gauge Height	Discharge	Gauge Height.	Discharge.	Gauge Height	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			1·5	34	2·83	272
2			1·57	41	2·83	272
3			1·6	44	2·77	256
4			1·5	34	2·67	231
5			1·45	30	2·63	221
6			1·47	32	2·5	190
7			1·57	41	2·37	161
8			1·67	51	2·5	190
9			2·1	110	2·17	183
10			2·5	190	2·35	157
11			2·15	179	2·3	147
12			2·52	195	2·2	128
13			2·5	190	2·25	138
14			2·37	161	2·10	110
15			2·3	147	2·1	110
16			2·3	117	2·17	123
17			2·35	157	2·13	115
18			2·37	161	2·07	105
19			2·3	117	2·13	115
20			2·4	167	2·33	153
21			2·15	179	2·13	115
22			2·17	183	2·2	128
23			2·6	214	2·07	105
24			2·75	251	2·15	119
25			2·85	278	2·17	123
26			2·87	284	2·17	123
27	1·6	44	2·9	292	2·17	123
28	1·6	44	2·87	284	2·13	115
29	1·55	39	2·8	264	2·03	98
30	1·53	37	2·7	258	2·0	93
31			2·83	272		

DAILY GAUGE HEIGHTS AND DISCHARGES of Bolean Creek near Slahaltkan for 1913—*Concluded.*

DAY.	July.		August.		September.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·07	105	1·43	28	1·2	14
2	2·03	98	1·37	24	1·15	12
3	1·9	79	1·43	28	1·2	14
4	1·85	73	1·35	23	1·3	20
5	1·77	60	1·35	23	1·3	20
6	1·7	54	1·35	23	1·25	17
7	1·65	49	1·35	23	1·23	16
8	1·63	47	1·5	34	1·2	14
9	1·6	44	1·47	32	1·25	17
10	1·65	49	1·43	28	1·2	14
11	1·93	83	1·35	23	1·15	12
12	1·85	73	1·35	23	1·15	12
13	1·95	86	1·35	23	1·15	12
14	2·45	179	1·35	23	1·15	12
15	2·27	141	1·37	24	1·15	12
16	2·17	123	1·35	23	1·15	12
17	2·07	105	1·4	26	1·15	12
18	1·97	89	1·47	32	1·2	14
19	1·87	75	1·55	39	1·15	12
20	1·77	60	1·47	32	.....	.....
21	1·67	51	1·4	26	.....	.....
22	1·65	49	1·35	23	.....	.....
23	1·6	44	1·35	23	.....	.....
24	1·52	36	1·35	23	.....	.....
25	1·5	34	1·35	23	.....	.....
26	1·45	30	1·3	20	.....	.....
27	1·4	26	1·25	17	.....	.....
28	1·4	26	1·25	17	.....	.....
29	1·55	39	1·2	14	.....	.....
30	1·53	37	1·2	14	.....	.....
31	1·47	32	1·2	14	.....	.....

BONAPARTE RIVER NEAR ASHCROFT.

Location.—Section 5, township 21, range 24, west 6th Meridian.

Records Available.—June 10 to November 6, 1911; March 25, to December 22, 1912; April 1 to December 31, 1913.

Winter Conditions.—A short and often severe winter with very light snowfall. Ice conditions usually exist during January and February.

Gauge.—Vertical staff gauge. Daily readings by H. Collins during the open season.

Channel.—The channel is about 50 feet in width and is straight for several hundred feet above and below the gauge. The control is good.

Discharge Measurements.—Measurements are made by wading in low water and by the "cable carrier" method in high water. Six well distributed measurements were obtained in 1913.

Accuracy.—The accuracy of the results obtained on this stream is high. The gauge height discharge curve is well defined and gauge readings were carefully taken.

General.—During 1913, the timber rock-fill dam on the Bonaparte river (of the Ashcroft Water, Electric and Improvement Company) failed, and the power plant has since been out of commission.

BONAPARTE RIVER.

The Bonaparte river rises in Bonaparte lake at an elevation of 3,800 feet, and discharges into Thompson river, near Ashcroft, at an elevation of 970 feet. Hat creek and Maiden creek (Graves creek) flow in from the west, and Cache creek and Scottie creek from the east. The drainage area is 2,000 square miles. The water is used for irrigation and for water-power. An attempt was made at the power plant of the Ashcroft Water, Electric and Improvement Company to pump water to the Boston flat by means of power obtained from the river, but owing to the high head to which it was necessary to lift the water, the scheme was not successful, since a large flow of water was required to supply the power.

The Bonaparte flows into the Thompson at Ashcroft, and drains a large watershed lying between the Fraser and the North Thompson. At the head waters of several of its branches there are lakes varying in elevation from 2,000 to 3,000 feet. Of these, Bonaparte lake is the largest, being about 10 miles long and 2 miles wide.

Near Ashcroft the Bonaparte has worn a canyon and flows through it for 3 miles or so. The power-house which formerly supplied Ashcroft with power and light is situated near the upper end of this canyon. There are other sites in the canyon, but it is doubtful if there will be much more power development on the stream because of the demand for water for irrigation. This power plant was out of commission in 1913, from a washout which took place in the spring.

Below the canyon there is some good land. The bottom land is being cultivated and irrigated, but the higher benches are arid. About 6 miles from the mouth of the river the valley widens out, and for 15 miles there is a fine stretch of good country. The Cariboo road runs up the valley, and a good deal of the land was taken up in the early days of the province. Even now it is the traffic on this road to Fort George and the northern interior that is the largest factor in the prosperity of the Bonaparte valley. The passengers are carried by automobiles, and make the run through to the boat landing at Soda creek on the Upper Fraser in one day. But the freighting is still done entirely by horses and wagons. These outfits travel about 20 miles a day, and furnish a good market for hay and oats.

The Bonaparte valley is in the dry belt. During the growing season there is almost continuous sunshine, with very little rain (8 or 10 inches). As a consequence nothing will grow without irrigation. But the soil is naturally rich, and when water is supplied, the growth is rapid. At present most of the lower land in the Bonaparte and tributary valleys is under cultivation, and the water supply is about sufficient under the present methods of irrigation. There is much good land on the higher benches and in the Semlin valley and Boston flat which could be irrigated by a long flume from the Bonaparte river. There is sufficient water in the river if the storage on the lakes is utilized, and by constructing one system to serve all, the price per acre would not be excessive. Potatoes do exceptionally well on this land, and Ashcroft potatoes have quite a reputation and bring the highest prices. In the summer, large herds of cattle feed on the good pasturage back on the hills, but they must be fed during the winter, and this makes good market for hay, so that even now the Ashcroft district is a good farming country, and could be made much better by an extensive irrigation system.

Twenty miles from the mouth, the wagon road leaves the Bonaparte valley and climbs to the plateau. This is quite near the boundary of the Railway Belt, so that the best part of the valley is inside this belt. North of the boundary the altitude is higher, the precipitation somewhat heavier, and there is more timber. It is in this part of the watershed that all the lakes lie. There is splendid fishing in many of them, and Indians go up there every fall in large numbers to catch fish for the winter. The Cariboo road does not touch the main stream outside the Railway Belt, and the only means of travelling is by pack trains.

The gauging station on the Bonaparte is at Mr. J. G. Collin's ranch, about 6 miles from the mouth of the stream. It is above the Ashcroft power-house and not far from the upper end of the canyon. The gauge is a five-foot vertical staff nailed to some small trees on the right bank of the stream at Collin's house. It is referred to three bench-marks so that any change of elevation can be detected and corrected. The meter measurements are made at a section about 100 feet above the gauge, where a wire has been stretched across the stream. At high water a carrier is put on this wire and the meter suspended from it by a cable. At low and medium stages the measurements are made at the same section by wading. The channel above the section is straight for 100 feet, and the water is swift. Below the section the channel is straight for 150 feet, and the water swift, though obstructed by one or two boulders. The right bank is 2 feet high, with a fringe of bushes and small trees, at very high stages the water might rise into the bushes. The left bank is 4 feet high and covered with bushes and trees. There could be only one channel even at high water. The bed of the stream is rocky and the water about 2 feet deep at ordinary stages. At the highest stages it is impossible to wade it. At very low water it might be necessary to remove a few shovelfuls of mud to keep open the communication between the little pool in which the gauge is placed and the main stream. At ordinary stages the gauge is in the main stream itself.

Discharge Measurements of Bonaparte River at Collin's Ranch, for 1913

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft	Ft. per sec.	Feet.	Sec.-ft.
April 25	Chisholm & Cline	1,055	54	153·4	4·35	2·96	[1]667
May 3	do do	1,055	48	114	3·63	2·30	415
May 19	K. G. Chisholm	1,055	54	154	4·30	2·81	664
May 27	do	1,055	54	160	4·65	2·99	745
July 31	do	1,055	45	81	2·87	1·76	[2]233
Oct. 3	do	1,055	37	51	1·67	1·09	85

Note.—[1] Cable measurement.
[2] Wading measurement.

Monthly Discharge of Bonaparte River at Collin's Ranch for 1913.

(Drainage area, 2,000 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April	885	124	408	0·20	0·22	24,278
May	680	340	553	0·28	0·32	34,003
June	655	340	486	0·24	0·27	28,919
July	540	230	399	0·20	0·23	24,534
August	245	145	184	0·09	0·10	11,314
September	145	80	104	0·05	0·06	6,188
October	124	72	106	0·05	0·06	6,518
November	115	80	100	0·05	0·06	5,950
December	105	72	86	0·04	0·05	5,288

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Daily Gauge Heights and Discharges of Bonaparte River 5 miles from mouth for 1913.

Day.	March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			1·3	124	2·4	455	2·85	655
2			1·3	124	2·35	435	2·85	655
3			1·3	124	2·3	415	2·8	630
4			1·3	124	2·25	397	2·8	630
5			1·3	124	2·2	380	2·75	607
6			1·3	124	2·15	360	2·75	607
7			1·3	124	2·1	340	2·7	585
8			1·35	135	2·15	360	2·65	562
9			1·35	135	2·3	415	2·6	540
10			1·4	145	2·5	495	2·5	495
11			2·15	360	2·5	495	2·45	475
12			2·05	325	2·55	517	2·4	455
13			1·85	260	2·6	540	2·4	455
14			1·9	275	2·6	540	2·35	435
15			1·9	275	2·7	585	2·3	415
16			2·1	340	2·65	562	2·25	397
17			2·45	475	2·65	562	2·2	380
18			2·6	540	2·75	607	2·1	340
19			2·8	630	2·75	607	2·1	340
20			2·9	680	2·8	630	2·2	380
21			3·1	780	2·8	630	2·25	397
22			3·3	885	2·8	630	2·2	380
23			3·2	830	2·9	680	2·2	380
24			3·1	780	2·9	680	2·2	380
25			3·0	730	2·9	680	2·2	380
26			2·9	680	2·9	680	2·3	415
27			2·75	607	3·0	730	2·6	540
28			2·65	562	3·0	730	2·6	510
29			2·5	495	2·9	680	2·7	585
30	1·25	1·14	2·4	455	2·9	680	2·6	540
31	1·25	1·14			2·85	655		

Daily Gauge Heights and Discharges of Bonaparte River 5 miles from mouth for 1913—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·6	540	1·7	215	1·4	145	1·05	80	1·2	105	1·2	105
2	2·5	495	1·65	202	1·35	135	1·0	72	1·2	105	1·15	96
3	2·6	540	1·6	190	1·35	135	1·05	80	1·2	105	1·15	96
4	2·55	517	1·6	190	1·3	124	1·1	87	1·2	105	1·1	87
5	2·5	495	1·6	190	1·3	124	1·1	87	1·25	115	1·1	87
6	2·45	475	1·55	178	1·3	124	1·1	87	1·25	115	1·1	87
7	2·45	475	1·55	178	1·25	115	1·1	87	1·25	115	1·1	87
8	2·4	455	1·55	178	1·25	115	1·1	87	1·25	115	1·1	87
9	2·4	455	1·5	166	1·25	115	1·15	96	1·2	105	1·1	87
10	2·35	435	1·5	166	1·2	105	1·15	96	1·2	105	1·1	87
11	2·3	415	1·5	166	1·2	105	1·15	96	1·2	105	1·05	79
12	2·25	387	1·5	166	1·2	105	1·2	105	1·2	105	1·05	79
13	2·3	415	1·55	178	1·2	105	1·2	105	1·15	96	1·1	87
14	2·35	435	1·58	178	1·2	105	1·2	105	1·15	96	1·1	87
15	2·45	475	1·5	166	1·2	105	1·25	115	1·15	96	1·1	87
16	2·5	495	1·5	166	1·2	105	1·25	115	1·25	115	1·1	87
17	2·4	455	1·55	178	1·15	96	1·3	124	1·25	115	1·1	87
18	2·35	435	1·6	190	1·15	96	1·3	124	1·15	96	1·1	87
19	2·3	415	1·65	202	1·1	87	1·3	124	1·1	87	1·1	87
20	2·3	415	1·7	215	1·1	87	1·3	124	1·07	82	1·1	87
21	2·2	380	1·8	245	1·15	96	1·3	124	1·05	80	1·1	87
22	2·15	360	1·8	245	1·15	96	1·3	124	1·05	80	1·1	87
23	2·1	340	1·7	215	1·15	96	1·3	124	1·1	87	1·1	87
24	2·0	310	1·6	190	1·15	96	1·3	124	1·15	96	1·05	79
25	1·95	292	1·55	178	1·1	87	1·3	124	1·1	87	1·2	105
26	1·85	260	1·55	178	1·1	87	1·25	115	1·1	87	1·15	96
27	1·8	245	1·5	166	1·1	87	1·25	115	1·05	79	1·02	75
28	1·8	245	1·5	166	1·1	87	1·25	115	1·1	87	1·0	72
29	1·75	230	1·45	155	1·05	80	1·25	115	1·2	105	1·0	72
30	1·75	230	1·45	155	1·05	80	1·25	115	1·25	115	1·0	72
31	1·75	230	1·4	145	.....	.....	1·2	105	.....	.....	1·0	72

CAMPBELL CREEK.

Location.—Section 22, township 19, range 16, west 6th meridian.

Records Available.—May 27 to October 4, 1911; April 1 to September 16, 1912; May 1 to August 31, 1913.

Winter Conditions.—Creek is usually frozen up during December, January, and February and there is little or no run-off in November and March.

Gauge.—Vertical staff gauge read daily by A. Holt.

Channel.—The channel is about 15 feet wide at the gauge. Flow varies from zero to a maximum of 48 second-feet (recorded on May 28, 1912).

Discharge Measurements.—The curve for 1913 is poorly defined, having only three meterings. A shifting channel at the gauge section was a source of considerable trouble.

Accuracy.—The returns for 1911 and 1912 are of high accuracy, but results for 1913 are poor, and very little reliance can be placed upon them. They are probably within 20 per cent of the truth.

CAMPBELL CREEK.

The right branch of Campbell creek rises in the Campbell meadows at an elevation of 2,200 feet: the stream discharges into the South Thompson at an elevation of 1,140 feet. Campbell creek is in the eastern portion of the dry belt, the annual precipitation at the mouth being from 8 inches to 10 inches, and at the headwaters from 12 inches to 15 inches. Campbell creek is a very contentious irrigation stream. The Hydrographic survey has two stations on it, one at Todd's Corners and the other at the Campbell Estate at the mouth. The latter for the purpose of making a study of seepage loss. A slight decrease in discharge is found between the two stations, a portion of the flow of Campbell creek joining the Thompson river as underground water.

The upper reaches of the creek are well timbered with British Columbia fir, jack pine and spruce, and there are large lakes at the head of Campbell creek proper. These lakes are Trapp, Shumway, and Napier. Their superficial area is large, and evaporation in this dry country is great. In the season of 1911 the run-off from these lakes was nil, all Campbell creek water coming down Scuittoe creek (the right branch of Campbell creek) from the Campbell meadows. The lakes are unreliable for storage purposes.

The Campbell estate holds the prior records on this stream, and controls practically the whole flow of Campbell creek.

The Campbell estate has constructed a small dam on Campbell meadows, where water is stored and is used in the late summer for irrigation.

At the height of the irrigation season (June 7) the two diversions above the station at Todd's Corners were carrying 4.5 second-feet; at no time did they exceed this amount, which is about their mean flow for the irrigation season.

The daily flow of Campbell creek, especially in the late summer, is not the true normal discharge of the stream but depends upon the artificial control of the storage reservoir.

The station at Todd's Corners was established on May 27, 1911, by C. E. Richardson, and daily gauge readings were taken during the irrigation seasons of 1911, 1912 and 1913. It is located at the highway bridge on the Kamloops-Grand Prairie road.

The gauge is a 5-foot standard vertical staff gauge, and is in a pool at the right side of the stream just below the bridge. In high water, measurements of the flow are made from the bridge, and in low water, by wading below the bridge. The Creek runs through a meadow but the banks are well defined and there is no danger of overflow.

The station at the Campbell estate is at the mouth of a canyon one quarter of a mile above the Kamloops-Ducks highway. The gauge is a standard vertical staff securely wedged in the rocks at the right bank of the stream.

Measurements are made by wading, the channel being well confined in high rocky banks, and the bed being very rough and rocky. Three bench-marks are located at each station and referred to the gauge datum.

Gauge readings were taken at this station from May 25 to September 20, 1911, and from May 10 to September 1, 1912.

Discharge Measurements of Campbell Creek, near Todd's Corners, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq.-ft.	Ft. per sec.	Feet.	Sec.-ft.
May 3	H. J. E. Keys	1,057	4	1·7	5·8	1·03	9·65
May 3	do	1,057	4	1·6	5·7	1·03	9·16
May 29	do	1,057	16	1·49	1·5	1·68	22·4

Note.—Gauge Reader—A. Holt.

Monthly Discharge of Campbell Creek near Todd's Corners for 1913.

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean Per square mile.	Mean.	Depth in inches on Drainage area.	Total in acre-feet.
May	23·7	6·8	10·6	·05	·06	652
June	24·8	10·2	15·9	·08	·09	946
July	13·9	8·2	10·3	·05	·06	633
August	8·8	5·5	6·9	·03	·03	424

Note.—There are some diversions for irrigation in the upper watershed not included in these figures.

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Daily Gauge Heights and Discharges of Campbell Creek near Todd's Corners for 1913.

Date.	May		June.		July.		August.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	0·85	7·1	1·74	24·0	1·20	11·7	0·9	7·6
2	0·86	7·2	1·73	23·7	1·20	11·7	1·0	8·8
3	0·95	8·1	1·77	24·8	1·20	11·7	1·0	8·8
4	1·16	11·1	1·65	21·4	1·20	11·7	1·0	8·8
5	1·13	10·6	1·51	17·9	1·20	11·7	1·0	8·8
6	1·05	9·5	1·47	17·0	1·20	11·7	0·9	7·6
7	0·98	8·6	1·42	15·9	1·15	11·0	0·87	7·3
8	1·00	8·8	1·30	13·5	1·10	10·2	1·0	8·8
9	1·00	8·8	1·50	17·7	1·02	9·1	0·97	8·4
10	1·02	9·1	1·48	17·3	0·95	8·2	0·92	7·8
11	1·05	9·5	1·57	19·4	1·02	9·1	0·86	7·2
12	1·05	9·5	1·52	18·2	1·15	11·0	0·85	7·1
13	1·05	9·5	1·50	17·7	1·25	12·6	0·85	7·1
14	0·98	8·6	1·47	17·0	1·30	13·5	0·82	6·8
15	0·95	8·2	1·45	16·6	1·32	13·9	0·82	6·8
16	0·92	7·8	1·50	17·7	1·20	11·7	0·82	6·8
17	0·92	7·8	1·45	16·6	0·98	8·6	0·80	6·6
18	0·90	7·6	1·45	16·6	0·96	8·3	0·80	6·6
19	0·87	7·3	1·45	16·6	1·00	8·8	0·77	6·4
20	0·85	7·1	1·50	17·7	1·00	8·8	0·77	6·4
21	0·92	6·8	1·30	13·5	1·05	9·5	0·75	6·2
22	0·87	7·3	1·20	11·7	1·10	10·2	0·75	6·2
23	1·05	9·5	1·12	10·5	1·10	10·2	0·72	6·0
24	1·17	11·2	1·15	11·0	1·10	10·2	0·72	6·0
25	1·26	12·8	1·17	11·2	1·10	10·2	0·72	6·0
26	1·25	12·6	1·15	11·0	1·08	9·9	0·72	6·0
27	1·32	13·9	1·10	10·2	1·02	9·1	0·72	6·0
28	1·41	15·7	1·10	10·2	1·00	8·8	0·72	6·0
29	1·53	18·4	1·10	10·2	1·00	8·8	0·67	5·6
30	1·72	23·4	1·15	11·0	1·00	8·8	0·65	5·5
31	1·73	23·7			0·96	8·3	0·65	5·5

CHERRY CREEK.

Location.—Section 34, township 19, range 19, west 6th, meridian.

Records Available.—June 5 to September 1, 1911; April 24 to September 15, 1912; April 19 to October 19, 1913.

Winter Conditions.—Stream is generally dry during October, November, December, January, and February. Winter conditions are not usually very severe.

Gauge.—Vertical staff gauge read daily by Henry Cornwall.

Channel.—The channel is about 10 feet wide. The maximum recorded flow was 200 section-feet, caused by the failure of a dam on Chuhwhels lake. The normal maximum is uncertain owing to the fact that the flow is artificially controlled.

Discharge Measurements.—It has been necessary to make numerous meterings, as continuous trouble has been met on account of the constant shifting of the stream-bed and washing out of gauges.

Accuracy.—The accuracy of results appended, on account of conditions mentioned above, is low. Returns, especially during high water, may be in error to 20 per cent.

CHERRY CREEK.

Cherry creek has its source in the hills south of Kamloops lake, at an elevation of 3,800 feet, and discharges into Kamloops lake, at an elevation of 1,120 feet. It is part of the Thompson drainage; the drainage area, as measured

from the Geological Survey map, dated 1895, scale 2 miles to 1 inch, is 70 square miles; of this area 33 square miles is above the gauge. Cherry creek has the following tributaries: Alkali creek, entering from the left, Dairy and Pendleton creek from the right, going upstream. Cherry creek, as well as its tributaries, is situated in the most arid section of the dry belt; the summers are hot and dry, the winters long and cold (-20° F.): the precipitation varies from 8 inches, near the mouth, to 12 inches at the headwaters.

Cherry creek is a contentious irrigation stream about 12 miles long. The upper 6 miles consists of dry range hills, with little irrigable land, but the lower half of the stream flows through wide benches, which only required water to become fertile agricultural lands. In a wet season like 1912, the creek will run for six or seven months at the station; in a dry season the stream cannot be depended on for more than three months. and then for a mean discharge of only 2 second-feet. In different sections of the stream conditions vary; near the mouth the creek runs all year; in other places the stream will be absolutely dry, while running a hundred yards above and below. Apparently there is a large amount of seepage in proportion to the size of the stream and this fact makes the measurement of the discharge very difficult. Cherry creek has excellent storage facilities in the following lakes: Big Meadow reservoir with a capacity of 1,250 acre-feet; Chuhwhels lake with a capacity of 525 acre-feet; Roper lake with a capacity of 525 acre-feet; Andrew lake and Cornwall lake, which have not been dammed as yet. These lakes, however, are so far upstream that their catchment basins are small, and only a little water can be conserved, the reservoirs rarely filling to their capacity. Cherry creek is greatly over-recorded; the many records on the creek call for over 4,400 miners inches, or over 120 second-feet, while the mean flow of recent years has been less than 10 second-feet during the whole irrigation season. To further increase the water supply of the Cherry Creek district, records were taken out by Cherry creek interests to divert water from Big Fish and Face lakes, which lakes are part of the Guichon drainage area, flowing southerly into the Nicola district. It is proposed to divert the water of these lakes across the divide and in a northerly direction of the Beaton and Cherry Creek estates: (for further information see remarks on Greenstone creek.) On May 15, 1912, during the freshet, the storage dam on Chuhwhels lake failed and washed out the gauge and the channel, too, was entirely altered. The dam was rebuilt in the summer of 1914.

The river station on Cherry creek was established June 5, 1911, by W. M. Carlyle. The measuring section is located above all diversions on the Kensington ranch, just beside the gauge. The gauge is fastened about 100 feet above the Cornwall diversion on the right bank. The gauge was washed out by the above mentioned dam failure, and a temporary one was located to complete the year 1912. All the measurements are made by wading; this would make an excellent measuring section, but for the possibility of seepage. The control is good, the current uniform, the banks high, and there is only one channel. The datum of the gauge is referred to three bench-marks.

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Discharge Measurements of Cherry Creek at Kensington Ranch, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq.-ft.	Ft. per sec.	Feet.	Sec.-ft.
May 1	H. J. E. Keys	1,057	7·0	2·9	2·1	0·33	[1]6·2
June 2	do	1,057	8·0	4·1	2·7	0·52	10·9
June 12	do	1,057	6·0	2·4	1·5	0·4	3·5
July 17	do	1,057	5·0	2·2	2·9	0·07	[1]6·3
Aug. 6	do	1,057	4·5	2·4	4·9	0·02	[2]11·7
Sept. 4	do	1,057	....	....	....	0·36	[3]5

Note.—[1]New Gauge.
[2]Different section.
[3]Estimated.
Gauge Reader-Henry Cornwall.
Stream bed shifted in freshets and new gauges had to be installed and new rating tables constructed.

Monthly Discharge of Cherry Creek at Kensington Ranch for 1913.

(Drainage area 33 square miles).

Month.	Discharge in Second-Feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	34	4·0	18·7	0·57	0·66	1,150
June	46	0·2	7·5	0·23	0·26	446
July	41	3·4	20·5	0·62	0·71	1,260
August	30·7	0·6	4·9	0·15	0·17	301
September	0·6	0·3	0·5	0·02	0·02	29

Note.—This stream is controlled by dams on the lakes near its source. The station is above all diversions.

Daily Gauge Heights and Discharges of Cherry Creek at Kensington Ranch for 1913.

Day.	April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			1·65	5·6	0·55	13·4
2			1·65	5·6	0·52	11·1
3			1·65	5·6	0·5	9·5
4			1·62	4·6	0·5	9·5
5			1·62	4·6	0·49	8·9
6			1·62	4·6	0·49	8·9
7			1·60	4·0	0·42	4·8
8			1·67	6·2	0·45	6·6
9			1·82	12·4	0·42	4·8
10			2·17	30·2	0·45	6·6
11			0·8	34·0	0·42	4·8
12			0·8	34·0	0·40	3·6
13			0·75	30·5	0·4	3·6
14			0·72	27·8	0·4	3·6
15			0·68	24·3	0·35	2·3
16			0·65	21·6	0·35	2·3
17			0·6	17·3	0·35	2·3
18			0·62	19·0	0·34	2·0
19	1·7	7·2	0·62	19·0	0·34	2·0
20	1·8	11·5	0·62	19·0	0·45	3·0
21	1·9	16·0	0·62	19·0	0·45	6·6
22	1·8	11·5	0·62	19·0	0·45	7·1
23	1·75	9·3	0·68	24·3	0·46	7·1
24	1·75	9·3	0·68	24·3	0·55	11·8
25	1·7	7·2	0·72	27·8	0·55	13·4
26	1·7	7·2	0·72	27·8	0·95	46·0
27	1·7	7·2	0·7	26·0	0·60	17·3
28	1·7	7·2	0·68	24·3	0·22	1·7
29	1·7	7·2	0·65	21·6	0·2	0·3
30	1·7	7·2	0·62	19·0	0·15	0·2
31			0·59	16·5		

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DAILY GAUGE HEIGHTS AND DISCHARGES of Cherry Creek at Kensington Ranch for 1913.—*Continued.*

Day.	July.		August.		September.		October.	
	Gauge Height.	Discharge.	Gauge Height	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·0	50·0	0·1	18·0	0·35	0·6	0·4	0·3
2	0·08	16·6	0·0	10·5	0·35	0·6	0·4	0·3
3	0·05	14·2	0·1	4·7	0·35	0·6	0·4	0·3
4	0·05	14·2	0·25	1·4	0·35	0·6	0·38	0·4
5	0·0	10·5	0·1	4·7	0·35	0·6	0·38	0·3
6	0·07	6·8	0·0	10·5	0·35	0·6	0·4	0·3
7	0·05	14·2	0·0	10·5	0·35	0·6	0·4	0·3
8	0·15	13·4	0·0	10·5	0·35	0·6	0·41	0·3
9	0·15	13·4	0·1	4·7	0·35	0·6	0·41	0·3
10	0·15	13·4	0·1	4·7	0·35	0·6	0·41	0·3
11	0·15	3·4	0·1	4·7	0·35	0·6	0·45	0·2
12	0·15	3·4	0·05	7·6	0·35	0·6	0·45	0·2
13	0·15	3·4	0·2	2·1	0·35	0·6	0·45	0·2
14	0·0	10·5	0·3	0·8	0·35	0·6	0·45	0·2
15	0·03	8·8	0·3	0·8	0·35	0·6	0·45	0·2
16	0·15	22·2	0·3	0·8	0·35	0·6	0·45	0·2
17	0·17	24·8	0·25	1·4	0·37	0·5	0·46	0·1
18	0·13	20·5	0·25	1·4	0·37	0·5	0·46	0·1
19	0·13	20·5	0·25	1·4	0·37	0·5		
20	0·18	24·8	0·3	0·8	0·37	0·5		
21	0·2	26·5	0·3	0·8	0·37	0·5		
22	0·2	26·5	0·32	0·7	0·37	0·5		
23	0·2	26·5	0·32	0·7	0·37	0·5		
24	0·28	32·5	0·32	0·7	0·37	0·5		
25	0·28	32·5	0·13	2·9	0·38	0·4		
26	0·3	35·0	0·0	10·5	0·38	0·4		
27	0·3	35·0	0·25	30·7	0·4	0·3		
28	0·38	41·0	0·32	0·7	0·4	0·3		
29	0·35	39·2	0·35	0·6	0·4	0·3		
30	0·35	39·2	0·35	0·6	0·4	0·3		
31	0·15	22·2	0·35	0·6				

COLDWATER RIVER AT MERRITT.

Location.—The station is located at Merritt, B. C., on the Nicola Valley branch of the Canadian Pacific Railway. It is about half a mile above the stream's confluence with the Nicola river.

Records Available.—April 17 to August 31, 1913.

Winter Conditions.—There is some severely cold weather during the winter months, and the stream is said to be usually frozen over in January and February.

Gauge.—Gauge is a vertical staff gauge, and was read during 1913 by D. McNeill. John Skimming is gauge reader for 1914.

Channel.—The stream is 50 to 75 feet in width, and its bed is stony. Velocities vary from 0·8 to 5·0 feet per second. During 1913 the maximum flow was 2,650 second-feet, while the minimum recorded flow was 40 second-feet.

Discharge Measurements.—Meterings are made by wading, during low stages, and by cable suspension from the upstream side of the traffic bridge at high water. The gauge-height-discharge curve is not well defined at present, but an effort will be made to have the stream well rated during 1914.

Accuracy.—Accuracy of results as shown cannot be vouched for. They are probably within 15 per cent of the truth.

General.—The Coldwater river (according to the Dominion sectional maps) has a drainage area of about 360 square miles. Rising in the Anderson River

hills (near the source of the stream of that name tributary to the Fraser) at an elevation of 6,000 feet, it flows northeast for a distance of 35 miles, joining the Nicola at the town of Merritt. The gauge was established by P. De Lautour on April 17, 1913. The waters of the Coldwater are utilized to some extent for irrigation, but there is no possibility of contention from this source. Their only probable use is as a source of water-power.

Discharge Measurements of Coldwater River near Mouth, 1913

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
April 17	P. DeLautour		66	98		0·25	243
" 29	do		67	127		0·50	396
May 2	do		66	106		0·30	307
" 10	do		73	187		1·60	1,130
" 14	H. J. E. Keys	1,057	65	202	5·0	1·23	1,010
" 16	do	1,057	63	160	5·2	1·05	836
" 26	do	1,057	71	281	6·6	2·35	1,850
" 27	P. DeLautour		80	304		2·50	1,980
June 3	do		125	337		3·35	2,390
July 29	H. J. E. Keys	1,057	60	94	1·3	0·15	122
Aug. 20	do	1,057	59	72	0·8	0·2	56

Monthly Discharge of Coldwater River at Mouth for 1913.

(Drainage area, 360 square miles.)

Month.	Discharge in Second-Feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	2,180	260	1,074	2·97	3·42	66,040
June	2,650	1,040	1,511	4·20	4·69	89,910
July	1,040	150	437	1·21	1·39	26,870
August	135	40	52	0·14	1·16	3,197

Note.—Gauge reader, D. McNeill.

DAILY GAUGE HEIGHTS AND DISCHARGES of Coldwater River at Mouth for 1913.

Day.	April.		May.		June.		July.		August.	
	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	.....	300	2·7	2,140	1·3	1,040	.....	135
2	.....	.....	0·3	260	2·9	2,300	1·0	800	.....	120
3	.....	.....	.....	260	3·35	2,650	0·9	720	.....	105
4	.....	.....	.....	260	3·1	2,460	0·8	650	.....	90
5	.....	.....	.....	260	2·5	1,980	0·7	570	.....	80
6	.....	.....	0·3	260	2·1	1,670	0·9	720	.....	70
7	.....	.....	0·55	450	2·2	1,750	1·05	840	.....	55
8	.....	.....	1·65	1,320	2·2	1,750	0·9	720	−0·3	40
9	.....	.....	1·15	920	2·3	1,830	0·7	570	−0·3	40
10	.....	.....	1·6	1,280	2·2	1,750	0·7	570	−0·3	40
11	.....	.....	1·5	1,200	2·2	1,750	0·7	570	−0·3	40
12	.....	.....	1·45	1,160	2·0	1,590	0·6	490	−0·3	40
13	.....	.....	1·3	1,040	2·1	1,670	0·5	410	−0·3	40
14	.....	.....	1·25	1,000	1·9	1,520	0·5	410	−0·3	40
15	.....	.....	1·2	960	1·5	1,200	0·4	330	−0·3	40
16	.....	.....	1·0	800	1·4	1,120	0·4	330	−0·3	40
17	0·25	220	1·3	1,040	1·35	1,080	0·4	330	−0·3	40
18	.....	.....	1·1	880	1·25	1,000	0·4	330	−0·3	40
19	.....	.....	1·1	880	1·55	1,240	0·4	330	−0·3	40
20	.....	.....	1·2	960	2·1	1,670	.....	345	−0·3	40
21	.....	.....	1·25	1,000	1·5	1,200	....	300	−0·3	40
22	.....	.....	1·75	1,400	1·5	1,200	....	285	−0·3	40
23	.....	.....	1·85	1,480	1·5	1,200	.....	270	−0·3	40
24	.....	.....	2·3	1,830	1·5	1,200	.....	255	.....	40
25	.....	.....	2·5	1,980	1·3	1,040	..	240	....	40
26	.....	.....	2·3	1,830	1·4	1,120	.....	225	.....	40
27	.....	.....	2·5	1,980	1·4	1,120	..	210	....	40
28	.....	.....	2·3	1,830	1·3	1,040	..	195	.....	40
29	0·5	410	2·15	1,710	1·3	1,040	.....	180	...	40
30	.....	380	2·0	1,590	1·3	1,040	..	165	.....	40
31	.....	340	2·75	2,180	.....	..	..	150	..	40

CRISS CREEK NEAR SAVONA.

Location.—Section 22, township 22, range 22, west 6th meridian.

Records Available.—June 14, 1912 to September 14, 1912; April 22, 1913, to November 21, 1913.

Winter Conditions.—Very little snow during the winter with only short periods of severe weather. Conditions essentially the same as in the Deadman valley.

Gauge.—Staff gauge read daily during the irrigation season by W. J. Hoey.

Channel.—The stream is well confined to a single channel, whose bed is of gravel and boulders.

Discharge Measurements.—Nine well distributed measurements have been obtained and the gauge-height-discharge curve is well defined for any flow up to 250 second-feet. Above this point, however, it has been necessary to project results, and an endeavour to ratify them will be made during 1914.

Accuracy.—The accuracy is high except during the freshet flow, when results cannot be vouched for.

CRISS CREEK.

Criss creek has its source in the hills between the headwaters of Deadman river and Tranquille river, at an elevation of about 6,000 feet. After a south-westerly course of about 25 miles it discharges into the Deadman river 10 miles above mouth, at an elevation of about 1,500 feet.

It is part of the Thompson River drainage and its drainage area, as measured from a Geological Survey map, dated 1895, is 150 square miles.

In the lower part of its source the creek flows swiftly through a narrow valley with steep sides and many sheer cliffs. In its upper reaches there is said to be considerable land suitable for homesteading. A number of homesteaders went in during the summer of 1913.

A rough pack trail leads up the creek from the mouth, and a road, which branches off from the Deadman river road about 15 miles from the mouth of Criss creek, strikes the creek again about 10 miles from its mouth.

The timber in the valley is of small size. There are several small lakes at the headwaters. The gauging station was established on June 14, 1912, by C. G. Cline. A vertical staff gauge is fastened to a large fir on the right bank of the stream, some 400 yards above the highway bridge. At low water, measurements are made by wading near the gauge, and at high water by cable suspension from the highway bridge.

Discharge Measurements of Criss Creek near Savona, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
June 14	C. Cline & Corbould		21	47·6	2·2	1·09	107
July 16	B. Corbould		245	31·4	1·2	0·7	38
Aug. 5	do		24	28·6	1·15	0·62	33
" 30	do		22	29·2	1·04	0·6	30
1913.							
April 22	C. Cline & Chisholm		30	114·0	1·9	1·62	217·0
May 17	K. G. Chisholm		30	123·6	2·03	1·72	251·0
June 10	do		30	99·95	1·72	1·49	176·00
Aug. 15	do		18	26·94	1·15	0·53	31·05
Oct. 4	do		13	13·4	0·91	0·18	12·1

Note.—Gauge reader, W. J. Hoey.

Monthly Discharge of Criss Creek at Mouth for 1913.

(Drainage area, 150 square miles.)

Month.	Discharge in Second-Feet.				Run-off.	
	Maximum.	Minimum	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	444	68	860	1·73	1·99	15,986
June	340	76	167	1·11	1·24	9,937
July	418	41	169	1·13	1·30	10,391
August	85	13	32	0·21	0·24	1,968
September	14	8	12	0·08	0·09	714
October	68	10	31	0·21	0·24	1,906
November	26	20	24	0·16	0·18	1,428

Note.—Gauge reader, W. J. Hoey.

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Daily Gauge Heights and Discharges of Criss Creek near Mouth for 1913.

Day.	April.		May.		June.	
	Gauge Height.	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			1·0	85	2·1	340
2			1·1	103	2·0	314
3			1·2	122	1·9	288
4			1·1	103	1·8	262
5			1·0	85	1·7	238
6			0·9	68	1·6	213
7			1·1	103	1·5	189
8			1·2	122	1·5	189
9			1·9	288	1·4	165
10			2·5	444	1·5	189
11			2·3	391	1·5	189
12			2·2	366	1·55	201
13			2·1	340	1·5	189
14			2·0	314	1·4	165
15			2·0	314	1·4	165
16			1·7	238	1·3	143
17			1·7	238	1·2	122
18			1·8	262	1·1	103
19			1·8	262	1·0	85
20			1·85	275	1·0	85
21			1·85	275	1·0	85
22	1·65	225	1·90	288	1·0	85
23	1·5	189	1·90	288	0·95	76
24	1·4	165	1·95	301	0·95	76
25	1·4	165	2·0	314	1·0	85
26	1·4	165	2·0	314	1·3	143
27	1·3	143	2·05	327	1·3	143
28	1·3	143	2·2	366	1·4	165
29	1·2	122	2·2	366	1·4	165
30	1·1	103	2·1	340	1·3	143
31	1·0	85	2·2	366		

DAILY GAUGE HEIGHTS AND DISCHARGES of Criss Creek near Mouth for 1913.

Day.	July.		August.		September.		October.		November.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·3	143	1·0	85	0·25	14	0·1	10	0·4	20
2	1·2	122	0·9	68	0·25	14	0·1	10	0·4	20
3	1·1	103	0·8	53	0·2	13	0·15	11	0·4	20
4	1·0	85	0·8	53	0·2	13	0·2	13	0·4	20
5	1·2	122	0·7	41	0·2	13	0·2	13	0·4	20
6	1·1	103	0·5	26	0·2	13	0·2	13	0·45	23
7	1·0	85	0·4	20	0·15	11	0·3	16	0·5	26
8	0·95	76	0·3	16	0·15	11	0·3	16	0·5	26
9	0·9	68	0·2	13	0·15	11	0·4	20	0·5	26
10	0·8	53	0·25	15	0·1	10	0·4	20	0·5	26
11	0·7	41	0·3	16	0·1	10	0·5	26	0·5	26
12	0·7	41	0·4	20	0·1	10	0·6	32	0·5	26
13	0·8	53	0·5	26	0·05	8	0·7	41	0·5	26
14	0·9	68	0·5	26	0·05	8	0·8	53	0·5	26
15	2·3	391	0·5	26	0·1	10	0·9	68	0·5	26
16	2·4	418	0·5	26	0·1	10	0·9	68	0·5	26
17	2·3	391	0·5	26	0·1	10	0·8	53	0·5	26
18	2·3	391	0·5	26	0·15	11	0·75	47	0·5	26
19	2·2	366	0·6	32	0·15	11	0·75	47	0·5	26
20	1·9	288	0·7	41	0·2	13	0·75	47	0·5	26
21	1·8	262	0·85	60	0·2	13	0·75	47	0·5	26
22	1·7	238	0·8	53	0·2	13	0·65	36	.....	.....
23	1·6	213	0·8	53	0·25	14	0·65	36	.....	.....
24	1·5	189	0·7	41	0·25	14	0·65	36	.....	.....
25	1·5	189	0·6	32	0·2	13	0·6	32	.....	.....
26	1·4	165	0·5	26	0·2	13	0·6	32	.....	.....
27	1·3	143	0·4	20	0·2	13	0·5	26	.....	.....
28	1·2	122	0·3	16	0·15	11	0·5	26	.....	.....
29	1·1	103	0·25	14	0·15	11	0·4	20	.....	.....
30	1·1	103	0·25	14	0·10	10	0·4	20	.....	.....
31	1·0	85	0·2	13	.....	.....	0·4	20	.....	.....

DEADMAN RIVER NEAR SAVONA.

Location of Station.—Section 22, township 22, range 22, west 6th meridian, half a mile above the mouth of Criss creek. This station was established in 1913 to replace a station below the mouth of Criss creek, upon which information was obtained during the irrigation seasons of 1911 and 1912.

Records Available.—April 22 to November 21, 1913.

Winter Conditions.—Very little snow on the lower benches, with only short periods of severe weather. Six to ten feet of snow in the upper reaches of the creek.

Gauge.—Staff gauge read daily during the irrigation season by W. J. Hoey.

Channel.—Channel is straight and control is good, while the velocity is great only during high stages.

Discharge Measurements.—Six well distributed measurements were obtained during 1913. Although a metering was not secured at the peak of the freshet the flow was deduced by the projection of the discharge curve. During 1914 this deduction will be ratified if possible.

Accuracy.—The accuracy is high except for the short period when flow was above 300 second-feet, which condition is mentioned above.

DEADMAN RIVER.

Deadman creek has its source in numerous small lakes between the headwaters of Tranquille creek and Bonaparte lake, some 20 miles west of the Thompson river. Most of these lakes are yet unnamed, and have an elevation of about 4,000 feet. The creek flows in a westerly direction for about 20

miles, then turns toward the south and, after a course of 30 or 35 miles farther, discharges into the Thompson river just below Kamloops lake, at an elevation of about 1,100 feet.

The chief tributaries are: from the left going upstream Clemes creek, Gorge creek, Tobacco creek, and Hunters creek. From the right, Criss creek, and Last Chance creek. The total drainage area from the Provincial Government map of the Yale district, dated 1912, scale 8 miles to 1 inch, is 500 square miles. The area above Criss creek, viz., above the measuring section, is 400 square miles. The water is used for irrigation only. The Barnes estate at Walhachin take water from Deadman creek. They have a dam on Deadman lake about 20 miles from the mouth of the creek. Their intake is about 10 miles from the mouth, and the water is carried by a 6 by 4-foot wooden flume to Walhachin.

There are several good power sites on the stream, which have not been developed. Just below the confluence of Hunters creek, 30 miles from the mouth there is a fall of 160 feet.

Deadman creek lies in the dry belt, with a precipitation near the mouth of about 10 inches. Like all streams in the dry belt, the precipitation increases toward the upper reaches with the increase in altitude. What is probably the best part of the valley is owned by Indians. They hold everything beyond the Anderson ranch to the Williams ranch, which is about 13 miles from Savona. This portion of the valley is excellent agricultural land, and beyond this for several miles it is narrow and extremely rough, then widens out again and there are stretches of good land, and several fine ranches have been developed.

A station was established just above the intake of the Walhachin flume (12 miles from Savona) on July 11, 1911. Readings were taken on the gauge at this point during the remainder of the irrigation season (1911) and the whole irrigation season (1912). It was replaced, however, in 1913 by a station installed above the confluence of Criss creek, which has been found to give better results, Criss creek itself also having been rated.

During 1911 readings were taken on a gauge 3 miles from the creek's mouth, with a view to finding the amount of water and to studying the question of seepage.

Discharge Measurements of Deadman River above Criss Creek, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913			Feet.	Sq.-ft.	Ft. per sec.	Feet.	Sec.-ft.
April 23	Cline & Chisholm	1,055	30	91·7	3·1	3·60	[1]281
April 22	K. G. Chisholm & C. G. Cline	1,055	40	72·8	3·5	3·52	[2]256
May 17	K. G. Chisholm	1,055	34	115·0	1·15	3·95	110
June 11	do	1,055	24·5	32·9	3·00	2·38	[3]98·6
Aug. 15	do	1,055	15·5	19·4	2·53	1·80	[4]19
Oct. 6	do	1·055	11·7	9·2	1·11	0·93	[4]10·2

Note.—[1]Measured from bridge.
[2]Measured 50 feet below gauge from bridge.
[3]Gauge wading 50 feet above.
[4]Gauge wading 20 feet above.

Monthly Discharge of Deadman River above Criss Creek, for 1913.

(Drainage area, 400 square miles).

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage	Total in acre-feet.
May	481	145	261	0·65	0·75	16,048
June	156	42	90	0·22	0·24	5,355
July	133	42	92	0·23	0·26	5,657
August	57	11	31	0·08	0·09	1,906
September	11	10	10	0·02	0·02	595
October	12	10	11	0·03	0·03	676
November	14	11	12	0·03	0·03	714
The period	481	10	73	0·18	1·42	30,951

Daily Gauge Heights and Discharges of Deadman River above Criss Creek for 1913.

Day.	April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			3·2	199	2·9	156
2			3·1	183	2·8	145
3			3·1	183	2·7	133
4			3·0	169	2·7	133
5			2·9	156	2·6	122
6			2·9	156	2·5	112
7			2·8	145	2·5	112
8			2·8	145	2·5	112
9			2·9	156	2·4	102
10			3·1	183	2·4	102
11			3·3	216	2·3	92
12			3·8	340	2·3	92
13			4·0	434	2·2	82
14			4·1	481	2·2	82
15			4·1	481	2·1	73
16			4·0	434	2·1	73
17			3·95	408	2·0	65
18			3·85	362	2·0	65
19			3·8	340	2·0	65
20			3·7	306	2·0	65
21			3·7	206	1·9	57
22	3·5	254	3·6	278	1·9	57
23	3·5	254	3·6	278	1·8	49
24	3·6	278	3·6	278	1·7	42
25	3·5	254	3·4	234	1·9	57
26	3·5	254	3·4	234	2·1	73
27	3·4	234	3·4	234	2·0	65
28	3·3	216	3·3	216	2·4	102
29	3·3	216	3·2	199	2·4	102
30	3·2	199	3·1	183	2·4	102
31			3·0	169		

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Daily Gauge Heights and Discharges of Deadman River above Criss Creek for 1913—*Continued.*

Day.	July.		August.		September.		October.		November.	
	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·4	102	1·7	42	1·0	11	0·9	10	1·0	11
2	2·4	102	1·6	36	1·0	11	0·9	10	1·0	11
3	2·5	112	1·6	36	1·0	11	0·9	10	1·05	12
4	2·4	102	1·6	36	1·0	11	0·9	10	1·0	11
5	2·4	102	1·6	36	1·0	11	0·9	10	1·0	11
6	2·4	102	1·6	36	0·9	10	0·9	10	1·0	11
7	2·3	92	1·6	36	0·9	10	0·9	10	1·0	11
8	2·3	92	1·6	36	0·9	10	0·9	10	1·0	11
9	2·2	82	1·8	49	0·9	10	0·9	10	1·0	11
10	2·2	82	1·7	42	0·9	10	0·9	10	1·0	11
11	2·1	73	1·7	42	0·9	10	1·0	11	1·0	11
12	2·2	82	1·9	57	0·9	10	1·0	11	1·05	12
13	2·2	82	1·8	49	0·9	10	1·05	12	1·1	14
14	2·2	82	1·8	49	1·0	11	1·05	12	1·1	14
15	2·3	92	1·8	49	1·0	11	1·0	11	1·1	14
16	2·5	112	1·8	49	1·0	11	1·0	11	1·1	14
17	2·5	112	1·6	36	0·9	10	1·0	11	1·1	14
18	2·6	122	1·5	30	0·9	10	1·05	12	1·1	14
19	2·6	122	1·4	25	0·8	10	1·05	12	1·1	14
20	2·7	133	1·4	25	0·95	10	1·0	11	1·1	11
21	2·6	122	1·4	25	0·9	10	1·0	11	1·1	14
22	2·5	112	1·3	20	0·9	10	1·0	11		
23	2·4	102	1·3	20	0·9	10	1·0	11		
24	2·3	92	1·3	20	0·9	10	1·0	11		
25	2·3	92	1·2	17	0·9	10	1·0	11		
26	2·2	82	1·2	17	0·9	10	1·0	11		
27	2·0	65	1·1	14	0·95	10	1·0	11		
28	1·9	57	1·1	14	0·95	10	1·0	11		
29	1·9	57	1·0	11	0·95	10	1·0	11		
30	1·8	49	1·0	11	0·95	11	1·0	11		
31	1·7	42	1·0	11			1·0	11		

DEADMAN RIVER (WALHACHIN FLUME).

Location.—Section 26, township 21, range 22, west 6th meridian.

Records Available.—July 15 to August 31, 1912; April 21 to August 16, 1913.

Gauge.—Gauge is a standard vertical staff gauge, and is read daily by R. McDonald, during the irrigation season.

Flume.—Six-foot timber flume, 4 feet deep, seams caulked with oakum, and the whole interior coated with tar. The flow is even.

Discharge Measurements.—The flume is fairly well rated by four meter measurements practically covering its range.

Accuracy.—Accuracy of results submitted is fairly high, and will be well defined during 1914.

WALHACHIN FLUME.

(Extract from report by P. A. Carson dated August 21, 1911.)

The source of water supply for Barnes estates is Deadman river, a stream 35 feet wide, from 2 to 4 feet deep. It rises in the hills (elevation 6,000 feet) some 40 to 50 miles north of the Thompson river, and flows in a general southerly direction.

The minimum discharge of Deadman river is about 16 second-feet at the end of August, and the maximum about 450 second-feet at the middle of May.

Just outside the northerly limit of the Railway Belt the river widens into a lake, called Snohoosh lake, or Deadman lake. This lake is a narrow winding body of water about 3 miles long, with a superficial area of 350 acres. It affords a good reservoir site, and to store the surplus waters of the spring freshet for the dry summer season, the company have constructed a dam at the outlet of the lake.

The dam is timber cribbed and rock-filled, the timber being lock-bolted together; it is founded on rock bed, and the base is concrete lined, with two 24-inch steel pipes laid in concrete. The dam is 140 feet long and 20·5 feet high, with a width at the base of 56 feet. The spillway is 90 feet wide, having a 3-foot parapet. By means of this dam 7,000 acre-feet of water can be stored. The natural flow of the river is ample for irrigation until July 15, when the stored waters are called upon until close of irrigation season, about August 15. The enormity of the spring flood may be comprehended when I say that after the freshet commenced the reservoir was filled in four days.

A conservative estimate of the duty of water in this locality is 100 acres per second-foot, and with the storage in Snohoosh lake there is sufficient water to irrigate 7,000 acres of land. The Barnes estates are already supplying water to the Savona Orchard Company, on Deadman Indian reserve, and are syphoning 5 second-feet across the Thompson river to the British Columbia Horticultural estates. They will probably also supply water to some ranches along Eight mile creek, adjoining their property on the west, and have constructed their canal with that object in view. Besides the Barnes estates there are several smaller users obtaining their water from Deadman river, and there is plenty for all.

Flumes and Ditches.

The main channel is about 10 miles long from the intake to the easterly boundary of the estate. In this portion there are 7½ miles of flume and 2½ miles of ditch.

The main flume is a 6-foot timber flume, 4 feet deep, and will carry 3 feet of water; it is made of 1¾-inch boards, well seasoned, the sides and bottom

are shiplapped, and the seams caulked with oakum, and the whole interior coated with tar, making a very permanent and watertight construction. The studdings (4 by 4) are alternately capped with cross-pieces to prevent spreading. Such a flume is perhaps not as permanent as a concrete or a steel flume, but is much cheaper, and will last for many years. The maximum grade is 5 feet to the mile, and the velocity is 3·8 feet per second.

The main ditch is slightly larger than the flume, but has the same capacity. The gravelly subsoil through which most of the ditch passes is rather porous, and last year a great deal of trouble was experienced with seepage, something like 40 per cent of the water being lost in transmission. By puddling the water with silt and a little concrete this difficulty has been almost entirely overcome.

However, I believe the greater portion of the ditch will have to be lined with concrete ultimately.

A right of way or easement for the main canal across the Indian reserve has been obtained, and is well fenced.

From the east half of section 10, township 21, range 22, to the east boundary of section 13, township 21, range 23, the main flume is a 4-foot construction similar to the 6-foot flume. It has a maximum capacity of 30 second-feet; the slope is 8 feet to the mile. Note the trestle work in photograph No. 8.

In the canal there are 15,600 feet of flume and 7,000 feet of ditch.

From the east boundary of section 13 to the west limit of the estate, the canal is 3 feet wide. It has a capacity of 18 second-feet, which is larger than is needed by this company, but it is proposed to supply water to some ranches adjoining the west. This flume is not tarred or capped as yet.

In the 3-foot canal there are 10,500 feet of flume and 5,550 feet of ditch.

Of the laterals for distributing the water of the different parts of the estate, there are 46,300 feet of small fluming, and 30,500 feet of small ditching. All the laterals leave the main canal from the flume, not ditch, and in consequence there is little danger of washout.

The distribution system is rather elaborate, and is not described here.

Monthly Discharge of Walhachin Flume near Head Gates for 1913.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
April	14·1	0	2·97	177
May	24·1	16·6	22·1	1,359
June	29·1	24·1	27·2	1,618
July	30·9	19·4	27·1	1,666
August	30·9	0	13·7	842

Total amount of water diverted in 1913=5,662 acre-feet.

Discharge Measurements of Walhachin flume near Head Gates, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
April 21	K. G. Chisholm	1,055	6·0	3·25	1·6	0·55	5·3

DAILY GAUGE HEIGHTS AND DISCHARGES of Walhachin Flume near Head Gates on Deadman River for 1913.

DAY.	April.		May.		June.		July.		August.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			1·1	16·6	1·35	24·1	1·35	24·1	1·55	30·9
2			1·1	16·6	1·35	24·1	1·3	22·5	1·5	29·1
3			1·2	19·4	1·35	24·1	1·3	22·5	1·5	29·1
4			1·2	19·4	1·35	24·1	1·3	22·5	1·45	27·4
5			1·2	19·4	1·35	24·1	1·35	24·1	1·4	25·7
6			1·3	22·5	1·4	25·7	1·35	24·1	1·3	22·5
7			1·3	22·5	1·4	25·7	1·35	24·1	1·5	29·1
8			1·3	22·5	1·45	27·4	1·4	25·7	1·5	29·1
9			1·3	22·5	1·45	27·4	1·4	25·7	1·5	29·1
10			1·3	22·5	1·45	27·4	1·4	25·7	1·5	29·1
11			1·3	22·5	1·5	29·1	1·45	27·4	1·4	29·1
12			1·3	22·5	1·5	29·1	1·45	27·4	1·4	29·1
13			1·3	22·5	1·5	29·1	1·2	19·4	1·4	29·1
14			1·3	22·5	1·5	29·1	1·3	22·5	1·4	29·1
15			1·3	22·5	1·5	29·1	1·4	25·7	1·4	29·1
16			1·3	22·5	1·45	27·4	1·4	25·7	[1]	[1]
17			1·3	22·5	1·5	29·1	1·5	29·1		
18			1·3	22·5	1·5	29·1	1·5	29·1		
19			1·3	22·5	1·5	29·1	1·55	30·9		
20			1·3	22·5	1·45	27·4	1·55	30·9		
21	0·55	6·0	1·3	22·5	1·45	27·4	1·55	30·9		
22	0·6	6·8	1·3	22·5	1·45	27·4	1·55	30·9		
23	0·6	6·8	1·3	22·5	1·45	27·4	1·55	30·9		
24	0·6	6·8	1·3	22·5	1·45	27·4	1·55	30·9		
25	0·0	0·0	1·3	22·5	1·45	27·4	1·5	29·1		
26	0·7	8·3	1·35	24·1	1·5	29·1	1·5	29·1		
27	0·9	12·0	1·35	24·1	1·5	29·1	1·5	29·1		
28	1·0	14·1	1·35	24·1	1·5	29·1	1·5	29·1		
29	1·0	14·1	1·35	24·1	1·4	25·7	1·55	30·9		
30	1·0	14·1	1·35	24·1	1·4	25·7	1·55	30·9		
31			1·35	24·1			1·5	29·1		

[1] End of irrigation season.

EAGLE RIVER AT MALAKWA.

Location.—In township 23, range 6, west 6th meridian, 15 miles from the mouth, at the traffic bridge near Malakwa, B. C.

Winter Conditions.—Heavy fall of snow, fairly severe weather (—20°F-). The river is generally partially frozen between November 15 and March 15.

Records Available.—May to December, 1913.

Gauge.—Chain gauge is used, and is read daily by Mr. Earl Swan, of Malakwa, B. C.

Channel.—The channel is uniform and straight for 100 yards above and below the gauge. The control has not yet been studied as to permanency.

Discharge Measurements.—Measurements are made from the upstream side of the traffic bridge, six well distributed measurements being made during 1913.

Accuracy.—Accurate gauge readings, careful meter measurements, and the appearance of the gauge-height-discharge curve tend to show that the 1913 data on this stream are very accurate; results, except in May and June, should be within 5 per cent.

General.—This station on Eagle river at Malakwa was established on May 14, 1913, to replace the station established in 1911, near Sicamous, where it was found there was a backwater effect from Shuswap lake during high water.

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Discharge Measurements of Eagle River near Malakwa, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 14	C. E. R. & J. A. E.	1,048	125	674	4·00	4·80	2,690
" 31	J. A. Elliott	1,672	132	1,100	6·46	6·80	7,110
June 7	do	1,672	132	1,090	6·20	6·70	6,750
July 10	do	1,672	128	740	4·14	5·12	3,060
Aug. 27	do	1,672	128	580	2·49	3·70	1,440
Nov. 7	E. M. D. & K. G. C.		125	468	1·32	2·61	620

Monthly Discharge of Eagle River near Malakwa for 1913.

(Drainage area, 420 square miles.)

Month.	Discharge in Second-Feet.			Run-Off.		
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	8,150		2,860	6·81	7·85	176,000
June	12,200	3,370	6,444	15·34	17·10	383,000
July	3,950	1,670	2,861	6·81	7·85	176,000
August	2,150	1,110	1,739	1·14	4·77	107,000
September	3,540	690	1,228	2·92	3·26	73,000
October	1,670	480	804	1·91	2·20	49,400
November	730	300	519	1·24	1·38	30,900
December	480	215	318	0·76	0·88	19,600

Note.—First thirteen days in May are estimated

Daily Gauge Heights and Discharges of Eagle River near Malakwa for 1913.

Day.	May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	.....	8,400
2	.....	.....	7·5	9,680
3	.....	.....	7·6	10,100
4	.....	.....	7·2	8,510
5	.....	.....	6·8	7,120
6	.....	.....	6·15	5,140
7	.....	.....	6·7	6,790
8	.....	.....	7·45	9,480
9	.....	.....	7·7	10,500
10	.....	.....	8·05	12,150
11	.....	.....	7·45	9,480
12	.....	.....	7·2	8,510
13	.....	.....	7·25	8,600
14	4·8	2,650	6·95	7,630
15	4·4	2,150	6·3	5,540
16	4·3	2,040	5·7	4,110
17	4·4	2,150	5·45	3,630
18	4·4	2,150	5·3	3,370
19	4·4	2,150	6·1	5,010
20	4·6	2,390	6·9	7,460
21	4·8	2,650	6·3	5,540
22	5·2	3,210	6·2	5,270
23	5·6	3,910	5·95	4,650
24	5·9	4,540	5·45	3,630
25	6·2	5,270	5·45	3,630
26	6·2	5,270	5·5	3,720
27	6·3	5,540	5·7	4,110
28	6·6	6,460	5·55	3,820
29	7·1	8,150	5·5	3,720
30	6·6	6,460	5·65	4,010
31	6·8	7,120	.....	.....

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DAILY GAUGE HEIGHTS AND DISCHARGES of Eagle River near Malakwa for 1913.

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	3,950	4·05	1,770	3·05	940	2·6	620	2·6	620	2·4	480
2	.....	3,880	4·2	1,930	2·9	830	2·8	760	2·55	600	2·3	420
3	5·55	3,820	4·15	1,880	4·7	2,520	2·6	620	2·55	600	2·2	370
4	5·05	2,990	4·1	1,820	5·4	3,540	2·55	590	2·55	600	2·2	370
5	4·9	2,780	4·1	1,820	4·2	1,930	2·45	520	2·6	620	2·2	370
6	4·9	2,780	4·15	1,880	3·8	1,530	2·5	550	2·7	690	2·2	370
7	5·1	1,060	4·2	1,930	3·55	1,310	2·5	550	2·6	620	2·2	370
8	5·25	3,290	4·3	2,040	3·6	1,350	2·45	520	2·55	590	2·2	370
9	4·95	2,850	4·35	2,100	3·8	1,530	2·4	480	2·55	590	2·2	370
10	5·15	3,140	4·15	1,880	3·6	1,350	2·4	480	2·65	660	2·2	370
11	5·0	2,920	4·1	1,820	3·5	1,270	2·4	480	2·65	660	2·1	330
12	4·9	2,780	3·9	1,620	3·5	1,270	2·7	690	2·65	660	2·1	330
13	5·15	3,140	4·15	1,880	3·5	1,270	3·95	1,670	2·75	730	2·1	330
14	5·2	3,210	4·4	2,150	3·5	1,270	3·3	1,110	2·7	730	2·1	330
15	5·2	3,210	4·3	2,040	3·25	1,080	3·2	1,040	2·5	550	2·1	330
16	5·2	3,210	4·2	1,930	3·25	1,080	3·05	940	2·4	480	2·1	330
17	5·0	2,920	4·1	1,820	3·2	1,040	2·9	830	2·3	420	2·0	300
18	4·85	2,720	4·15	1,880	3·6	1,350	2·85	800	2·3	420	2·0	300
19	5·15	3,140	4·1	1,820	3·35	1,150	2·9	830	2·35	450	1·9	270
20	5·15	3,140	4·1	1,820	3·15	1,000	2·9	830	2·1	330	1·8	250
21	5·0	2,920	4·1	1,820	3·2	1,040	2·8	760	2·0	300	1·8	250
22	5·0	2,920	3·95	1,670	3·2	1,040	2·9	830	2·1	330	1·7	230
23	4·95	2,850	4·1	1,820	3·0	900	2·9	830	2·1	330	1·6	215
24	4·9	2,780	3·95	1,670	2·9	830	3·6	1,350	2·3	420	1·6	215
25	4·65	2,470	3·8	1,530	2·8	760	3·2	1,040	3·2	370	1·6	215
26	4·55	2,330	3·85	1,580	2·8	760	3·2	1,040	2·1	330	2·0	300
27	4·4	2,150	3·7	1,440	2·8	760	3·05	940	2·2	370	2·1	330
28	4·35	2,100	3·4	1,190	2·8	760	3·2	1,040	2·5	550	2·1	330
29	4·2	1,930	3·3	1,110	2·7	690	2·9	830	2·4	480	2·0	300
30	3·95	1,670	3·3	1,110	2·7	690	2·75	730	2·4	480	1·8	250
31	3·95	1,670	3·35	1,150	.....	.....	2·6	620	.....	.....	1·8	250

ESSELL CREEK NEAR ADELPHI.

Location.—Section 35, township 17, range 14, west 6th meridian, below Summit Lake tributary to Salmon river.

Records Available.—May 25 to September 30, 1911; April 1 to September 7, 1912; April 16 to September 14, 1913.

Winter Conditions.—Winter conditions are not as a rule severe. The stream is usually dry during the winter months. A storage dam on Summit lake controls its regimen.

Gauge.—A standard vertical staff gauge, read tri-weekly by T. F. Teagle.

Channel.—The channel is gravelly, and there is no possibility of overflow at the gauge. The control is good.

Discharge Measurements.—Well distributed meterings have been made covering the stream's range.

Accuracy.—The accuracy of results appended is fairly high, within 10 per cent.

ESSELL CREEK.

Essell creek, locally known as Summit Lake creek, has its source in Summit lake near the divide between Monte creek and Grand Prairie, at an elevation of 2,050 feet, and discharges into the Salmon river near Grand Prairie, at an elevation of 1,800 feet. Its drainage area is a little over 6 square miles and its natural run-off is very small. A diversion has, however, been made from Monte

creek to Summit lake by a ditch about a mile long, and it is this Monte creek water which provides the greater part of the flow of Essell creek. This water is used around Grand Prairie, where there are over 5,000 acres of land under cultivation. The precipitation in the Essell creek drainage area is from 12 inches to 15 inches, and the evaporation losses from Summit lake are great.

The station was established on May 25, 1911, by C. E. Richardson, and daily gauge readings have been taken during the irrigation seasons of 1911, 1912, and 1913.

The measuring section is 100 yards from highway from Grand Prairie to Ducks, 2 miles from Grand Prairie and 50 yards above the gauge.

The gauge is a vertical staff gauge 5 feet long. Measurements are made with wading equipment from two planks thrown across the stream.

The banks are gently sloping, with no chance of overflow. The bed of the stream is of sand and gravel. Three bench-marks have been placed at the station and their elevations referred to the datum of the gauge.

Discharge Measurements of Essell Creek, near Grand Prairie, 1913.

Date.	Hydrographer.	Meter No	Width.	Area of Section.	Mean Velocity	Gauge Height	Discharge
1911			Feet	Sq. ft.	Ft. per sec.	Feet	Sec.-ft.
May 25	W. M. Carlyle	1041	10	11·3	1·74	1·30	19·7
" 25	C. E. Richardson	1048	11	14·6	1·71	1·21	16·2
" 25	C. G. Chne	1046	12	12·7	1·28	1·20	16·2
June 5	C. E. Richardson	1048	11	13·6	1·79	1·42	24·5
Aug. 24	W. M. Carlyle	1044	9	3·6	0·73	0·83	2·7
" 24	do	1044	9	3·3	0·74	0·81	2·5
1912.							
May 10	C. E. Richardson	1048	11	15·4	2·12	1·80	32·7
July 15	do	1048	10·5	6·1	1·61	1·22	9·8
" 17	do	1048	10	5·6	1·57	1·18	8·8
Aug. 27	do	1049	9	2·8	0·93	0·98	2·6
Apr. 21	H. J. E. Keys	1057	5	1·8	1·50	1·00	2·7
June 19	do	1057	10	12·5	1·5	1·53	18·9
July 11	do	1057	10	9·2	1·2	1·32	11·2

Monthly Discharge of Essell Creek, near Grand Prairie for 1913.

[Drainage area, 6 square miles.]

Month.	Discharge in Second-Feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	20	7	10·4	1·73	1·99	640
June	22·8	19	20·6	3·63	1·05	1,225
July	22	3·1	10·2	1·70	1·96	627
August	8·6	4	6·7	1·12	1·29	410

Note.—Artificial control.

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Daily Gauge Heights and Discharges of Essell Creek near Grand Prairie for 1913.

Day.	April.		May		June.		July.		August.		September.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet.	Sec.-ft.
1				4·2		20·1	1·55	22·0		8·4		4·6
2			1·15	7·6		20·2		18·0	1·18	8·6		5·2
3				7·5		20·3		15·0		8·0	1·09	5·7
4				7·4	1·51	20·4	1·3	12·7		7·5		5·6
5				7·3		20·2		13·0	1·13	7·0		5·5
6				7·2		20·1		13·3		7·1	1·08	5·4
7			1·13	7·0	1·5	20·0		13·6		7·2		5·2
8				7·4		20·0		13·9		7·4		5·0
9				7·8		20·0		14·2	1·15	7·6		4·8
10			1·17	8·2		20·0	1·35	14·6		7·2	1·05	4·5
11				9·9	1·5	20·0		15·0		6·8		4·4
12				11·6		19·7		15·2		6·4		4·3
13				13·3		19·3	1·37	15·4	1·1	6·0	1·1	4·3
14			1,36	15·0	1·47	19·0		11·0		6·4		
15				15·1		19·2		7·0		6·8		
16	0·96	2·2		15·2		19·4	1·0	3·1	1·11	7·2		
17		1·7	1·37	15·4		19·7		1·6		7·6		
18		1·2		15·7	1·5	20·0		6·1		8·0		
19	0·88	0·8		16·0		20·1	1·15	7·6		8·3		
20		1·2		16·2		20·2		6·8	1·18	8·6		
21		1·6	1·4	16·5	1·51	20·4		6·0		7·8		
22		2·0		17·2		20·8		5·2		6·9		
23	0·97	2·4		17·9		21·5	1·05	4·5	1·1	6·0		
24		3·0	1·46	18·6		22·2		5·5		5·8		
25		3·5		19·0	1·57	22·8		6·5		5·6		
26	1·03	4·0		19·3		22·8	1·15	7·6		5·5		
27		3·2		19·6		22·8		7·8	1·08	5·4		
28		2·4	1·5	20·0	1·57	22·8		8·0		5·0		
29		1·6		20·0		22·6		8·1		4·5		
30	0·88	0·8		20·0		22·4	1·17	8·2	1·03	4·0		
31			1·5	20·0				8·3		1·3		

FRASER RIVER AT LYTTON.

Location.—Section 12, township 15, range 27, west 6th, meridian, at ferry about a mile above town of Lytton, and above the confluence of the Fraser and Thompson rivers.

Records Available.—February 20 to December 31, 1912; January 1 to December 31, 1913.

Winter Conditions.—Open flow throughout the year.

Gauge.—Gauge painted on rock and graduated to feet. Readings made by J. C. Lual.

Channel.—The channel varies in width from 200 feet at low water to 800 feet at high water. The flow is uniform, but velocities are very great during the high stages of the water.

Discharge Measurements.—Seven well distributed meterings have been taken, ranging from 11,500 second-feet to 162,000 second-feet. The curve has been projected beyond these points.

Accuracy.—Conditions for gauge reading are good. Meterings are made from the ferry boat, which swings somewhat from side to side in the current, and probably affects the accuracy of the high-water measurements to a slight extent. The results, however, are considered to be within 10 per cent of the truth throughout.

Discharge Measurements of Fraser River at Lytton, 1913.

Date	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
September 5...	Cline and Chisholm.....	1055	540	7,860	9·53	21·0	74,90

Monthly Discharge of Fraser River at Lytton for 1913.

[Drainage area, 63,000 square miles.]

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage Area.	Total in acre-feet.
January	16,500	1,500	7,556	0·12	0·14	464,500
February	13,000	5,750	9,150	0·14	0·15	508,100
March	13,875	7,000	10,200	0·16	0·18	627,200
April	56,000	9,500	26,452	0·42	0·47	1,573,900
May	142,500	28,500	79,746	1·27	1·47	4,903,600
June	182,000	136,250	160,754	2·55	2·84	9,565,000
July	142,500	99,250	123,315	1·96	2·26	7,583,000
August	114,875	62,500	86,052	1·37	1·58	5,290,000
September	99,250	53,000	71,083	1·13	1·26	4,230,000
October	71,500	44,000	55,500	0·88	1·01	3,413,000
November	47,000	20,500	30,858	0·49	0·55	1,835,000
December	28,500	13,000	20,540	0·33	0·38	1,263,000
The year	182,000	1,500	56,767	0·90	12·29	41,256,300

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Daily Gauge Heights and Discharges of Fraser River above mouth of Thompson River for 1912.

Day.	February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge.
	Feet.	Sec.-ft	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	.....	7,800	9·5	10,800	18·0	51,200	30·0	126,500
2	.....	.....	9·0	8,800	.....	12,400	19·00	56,800	29·0	119,800
3	.....	.....	.....	8,800	.....	14,000	.....	62,600	28·0	113,200
4	.....	.....	.....	8,800	.....	15,600	21·0	68,500	27·0	106·600
5	.....	.....	9·0	8,800	.....	17,200	.....	65,500	26·0	100,000
6	.....	.....	.....	8,800	11·5	18,900	20·0	62,500	24·0	87,000
7	.....	.....	.....	8,800	.....	19,400	20·0	62,500	24·0	87,000
8	.....	.....	.....	8,800	.....	19,900	.....	68,500	24·0	87,000
9	.....	.....	.....	8,800		20,400	22·0	74,500	23·0	80,700
10	.....	.....	9·0	8,800	.....	21,000	22·0	74,500	23·0	80,700
11	.....	.....	.....	8,800	.....	23,200	23·0	80,700	24·0	87,000
12	.....	.....	.....	8,800	13·0	25,500	.....	80,700	25·0	93,500
13	.....	.....	9·0	8,800	13·5	27,900	23·0	80,700	26·0	100,000
14	.....	.....	.....	9,100	.....	28,700	23·0	80,700	27·0	106,600
15	.....	.....	.....	9,400	.....	29,500	24·0	87,000	28·0	113,200
16	.....	.....	.....	9,700	14·0	30,300	25·5	96,750	29·0	119,800
17	.....	.....	.....	10,000	.....	31,500	27·0	106,600	30·0	126,500
18	.....	.....	.....	10,400	14·5	32·800	29·0	119,800	31·0	133,500
19	.....	.....	9·5	10,800	.....	35,400	.....	126,600	29·0	119,800
20	10·5	14,800	.....	10,800	15·5	37,850	31·0	133,500	30·0	126,500
21	.....	13,800	.....	10,800	.....	39,100	29·0	119,800	32·0	140,500
22	.....	12,800	9·5	10,800	16·0	40,400	28·0	113,200	35·0	162,000
23	.....	11,800	10·0	12,800	.....	41,300	28·0	113,200	36·0	169,500
24	9·5	10,800	.....	10,800	.....	42,200	28·0	113,200	36·0	169,500
25	.....	10,100	9·0	8,800	16·5	43,000	28·0	119,800	36·5	173,000
26	.....	9,400	9·5	10,800	.....	45,700	.....	126,600	34·0	155,500
27	9·0	8,800	.....	10,800	17·5	48,400	31·0	133,500	34·0	155,500
28	.....	7,800	9·5	10,800	.....	49,300	33·0	148,000	33·0	148,000
29	8·5	6,800	.....	10,800	.....	50,200	34·0	155,500	32·0	140,500
30	.....	7,506	.....	10,800	18·0	51,200	34·0	159,250	.....	137,000
31	.....	.....	.....	10,800	.....	.....	32·5	144,250	.....	.....

Daily Gauge Heights and Discharges of Fraser River above mouth of Thompson River for 1912.

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	31·0	133,500	21·0	68,500	19·0	56,800	14·5	32,800	.....	25,500	10·0	12,800
2	28·0	113,200	20·5	65,500	18·0	51,200	14·5	32,800	.....	25,500	10,0	12,800
3	27·0	106,600	20·0	62,500	18·0	51,200	14·0	30,300	13·0	25,500	10·0	12,800
4	26·0	100,000	22·5	77,600	17·5	48,400	14·0	30,300	13·0	25,500	10·0	12,800
5	25·0	93,500	22·5	77,600	18·0	51,200	14·5	32,800	13·0	25,500	10·0	12,800
6	25·0	93,500	23·0	80,700	18·0	51,200	18·0	51,200	13·0	25,500	10·0	12,800
7	25·0	93,500	23·0	80,700	17·0	45,600	17·0	45,600	13·0	25,500	10·0	12,800
8	25·0	93,500	23·0	80,700	17·5	48,400	16·5	43,600	13·5	27,900	11·0	16,800
9	25·0	93,500	23·5	82,850	18·0	51,200	16·0	40,400	13·5	27,900	12·0	21,000
10	25·0	93,500	23·5	82,850	17·0	45,600	16·0	40,400	13·0	25,500	12·0	21,000
11	25·0	93,500	23·0	80,700	17·0	45,600	16·5	43,000	12·5	23,250	12·5	18,900
12	24·0	87,000	23·0	80,700	17·0	45,600	17·0	45,600	12·0	21,000	12·0	21,000
13	24·0	87,000	23·0	80,700	17·0	45,600	16·5	43,000	12·0	21,000	12·0	21,000
14	24·0	87,000	24·0	87,000	17·0	45,600	16·0	40,400	11·5	18,900	12·0	21,000
15	25·0	93,500	23·5	83,850	17·5	48,400	16·0	40,400	11·0	16,800	11·0	16,800
16	26·0	100,000	23·0	80,700	17·0	45,600	16·0	40,400	11·0	16,800	11·0	16,800
17	25·0	93,500	22·5	77,600	17·0	45,600	16·0	40,400	11·5	18,900	10·0	12,800
18	24·0	87,000	22·0	74,500	17·0	45,600	16·0	40,400	11·5	18,900	10·0	12,800
19	23·0	80,700	21·0	68,500	17·0	45,600	15·5	37,850	12·0	21,000	10·0	12,800
20	22·5	77,600	23·0	80,700	17·0	45,600	15·0	35,300	12·0	21,000	11·0	16,800
21	...	76,000	23·0	80,700	16·0	40,400	15·0	35,300	12·0	21,000	10·0	12,800
22	22·0	74,500	23·0	80,700	16·0	40,400	15·0	35,300	12·5	23,250	10·0	12,800
23	23·0	80,700	23·0	80,700	17·0	45,600	15·0	35,300	12·5	23,250	11·0	16,800
24	23·0	80,700	23·0	80,700	16·0	40,400	15·0	35,300	12·0	21,000	10·0	12,800
25	23·5	83,850	24·0	87,000	15·5	37,850	15·0	35,300	12·0	21,000	10·0	12,800
26	23·5	83,850	24·0	87,000	15·0	35,300	15·0	35,300	11·5	18,900	10·0	12,800
27	23·0	80,700	24·0	87,000	15·0	35,300	14·5	32,800	11·0	16,800	10·0	12,800
28	23·0	80,700	24·0	80,700	15·0	35,300	14·0	30,300	11·0	16,800	10·0	12,800
29	22·0	64,500	23·0	80,700	15·0	35,300	14·0	30,300	10·5	14,800	.....	12,800
30	21·5	71,500	21·0	58,500	14·5	32,800	13·3	27,900	.....	13,800	.....	12,800
31	21·0	68,500	20·0	62,560	.....	.....	13·0	25,500	.....	.....	.....	12,800

GREENSTONE CREEK.

Location.—Section 33, township 17, range 20, west 6th meridian.

Records Available.—May 1 to August 1, 1912; April 27 to August 24, 1913.

Winter Conditions.—Stream is generally dry during the months of October, November, December, January, February and March.

Gauge.—A vertical staff gauge, read semi-weekly by R. L. Burgess.

Channel.—The channel is about 10 feet in width. The maximum recorded flow was 95 second-feet, which occured on May 9, 1912.

Discharge Measurements.—The curve is only fairly well defined, although ten meterings have been made. A shifting channel is the probable cause of inaccuracy.

Accuracy.—The accuracy is not very high, but results are considered to be within 15 per cent of the truth.

GREENSTONE CREEK.

Greenstone creek has its source in Big Fish lake township 18, range 20, west 6th meridian, at an elevation of 4,820 feet, and discharges into Meadow creek 8 miles from the mouth, at an elevation of 4,000 feet. It is part of Guichon-Nicola-Thompson drainage; the drainage area, as measured from the Geological Survey map, dated 1895, scale 2 miles to 1 inch, is 20 square miles. This is a contentious irrigation stream, in the dry belt; the summers are hot and dry, the winters long and very cold (-30 F.); the mean annual precipitation is about 15 inches.

Greenstone creek is about 6 miles long, and drains Face and Big Fish lakes. There is no agricultural land except the Watson meadows at the mouth; there is a record of 1,000 inches appurtenant to this land. In addition the British Columbia Fruitlands Company, and the Beaton estate have records of 500 inches each to divert water from Face lake and Big Fish lake, respectively, into the Thompson drainage; while the mean run-off of the creek during the irrigation season of 1912 (an exceptionally wet season) was less than 10 second-feet, or 350 inches. The British Columbia Fruitlands Company propose to turn water from Face lake into the headwaters of Cherry creek, and thence via Cherry creek to their estates. The Beaton estate propose to build an earthen ditch 22 miles long in a northwesterly direction to their ranch in the Cherry creek valley; the ditch would receive water from Duffy, Chartrand, and Three-mile creeks, en route, provided the application for water for these estates were granted. The combined area of Big Fish and Face lakes is approximately 500 acres, and the lakes could be dammed to a height of 15 feet. Both of these schemes are meeting with strenuous opposition from the interests on Guichon creek.

The river station was established September 14, 1911, by W. M. Carlyle. The measuring section is located about half mile from the mouth. A standard vertical staff gauge is located on the left bank at the measuring section. All the measurements are made by wading, though in high water, measurements have to be made at the Chartrand-Trout lake road where the water runs in two channels. The measuring section is only fair, as part of the creek apparently sinks, reappearing below the measuring section. The control, however, is good, the current uniform, the channel permanent, and the banks not liable to overflow unless the channel were blocked by logs, which are abundant.

Discharge Measurements of Greenstone Creek, near Mouth, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 10	H. J. E. Keys	1,057	10·5	7·1	2·7	0·98	19·3
May 28	do	1,057	10·	7·1	2·2	0·91	[1]15·5
Sept. 1	do	1,057	.....	.....	.....	0·50	1·0

Note—Gauge Reader—R. L. Burgess.
[1]Estimated.

Monthly Discharge of Greenstone Creek near Mouth for 1913.

(Drainage area, 20 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	26	3·8	15·4	0·77	0·89	947
June	20·5	3·8	9·3	0·46	0·51	553
July	17·6	3·5	8·0	0·4	0·46	492
August	.....	.....	3·0	0·15	0·17	184

Note.—This station gives the flow from Big Fish lake to Face lake.

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DAILY GAUGE HEIGHTS AND DISCHARGES of Greenstone Creek near Mouth for 1913.

DAY.	April.		May.		June.		July.		August.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1				10·7		10·9		17·6		3·4
2				10·2		9·3		16·7		3·2
3				9·7		8·7	0·9	15·7		3·0
4			0·75	9·2		8·0		14·9		2·9
5				6·6	0·7	7·3		14·1		2·8
6			0·6	3·8		7·3	0·85	13·4		2·6
7				7·5		7·3		11·4	0·55	2·4
8			0·8	11·2	0·7	7·3		9·3		2·4
9				16·1		6·9	0·7	7·3	0·55	2·4
10				21·0		6·5		6·7		2·5
11			1·1	26·0		6·1		6·1		2·6
12				26·0		5·7	0·65	5·5		2·7
13			1·1	26·0		5·4		5·6		2·8
14				24·2		5·0		5·7		2·9
15				22·4		4·6		5·9		3·0
16			1·0	20·5		4·2		6·1		3·1
17				19·2	0·6	3·8		6·2		3·2
18				18·5		4·3		6·4		3·3
19				17·8		4·8		6·6		3·4
20				17·2	0·65	5·5		6·8		3·5
21				16·6		7·4		7·0		3·6
22				16·0	0·75	9·3		7·2		3·7
23				15·4		11·1	0·7	7·3	0·6	3·8
24				14·8		12·9		6·6		
25				14·2		14·7		6·0		
26				13·6		16·5		5·3		
27				13·0		18·4		4·5		
28	0·8	11·2		12·4	1·0	20·5	0·6	3·8		
29		11·2		11·8		19·5		3·7		
30	0·8	11·2	0·8	11·2		18·6		3·6		
31				10·6				3·5		

GUICHON CREEK (ABOVE MAMIT LAKE).

Location.—Water District No. 3, south of township 17, range 21, west 6th meridian.

Records Available.—June 3, 1911; January 1, 1912, to November 15, 1912; April 25, 1913, to September 29, 1913.

Winter Conditions.—Winter conditions exist during January, February and March, when the normal minimum flow is about 5 second-feet.

Gauge.—The gauge is a vertical staff gauge read daily by Miss Lillian Quenville.

Channel.—The channel is about 25 feet in width, and has a bed of sand and gravel. The maximum recorded flow is 4.35 second-feet, which occured on May 16, 1912.

Discharge Measurements.—The curve is well defined by numerous meterings.

Accuracy.—The accuracy of returns is high, and results are considered to be within 5 per cent of prevailing conditions.

Discharge Measurements of Guichon Creek, above Mamit Lake, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 28	H. J. E. Keys	1,057	26	77·6	1·6	3·44	126
Aug. 2	do	1,057	26	21·2	1·1	1·49	25·5
Aug. 17	do	1,057	24	16·3	1·06	1·20	17·3

Note.—Gauge reader, Miss Olive Quenville.

Monthly Discharge of Guichon Creek, above Mamit Lake, for 1913.

(Drainage area, 315 square miles).

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	179	41	122	0·38	0·44	7,501
June	230	55	86	0·27	0·30	5,111
July	164	28	72	0·23	0·26	4,427
August	41	18	24	0·08	0·09	1,476
September	24	16	18	0·06	0·07	1,071

Note.—This station gives the amount of water available for storage purposes in Mamit lake. During the spring freshet, J. E. Leighton, of Savona, diverts water into Tunkwa lake, and thence into the Three-mile Creek watershed.

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DAILY GAUGE HEIGHTS AND DISCHARGES of Guichon Creek near Mamit Lake for 1913.

Day.	April.		May.		June.		July.		August.		September.	
	Gauge Height	Discharge	Gauge Height.	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			2·05	54	2·92	107	3·8	164	1·45	26	1·25	18
2			2·05	54	2·75	96	3·5	143	1·45	26	1·25	18
3			2·0	51	2·6	87	3·4	136	1·42	25	1·25	18
4			1·94	48	2·45	78	3·25	126	1·4	24	1·25	18
5			1·9	46	2·3	69	3·1	117	1·4	24	1·25	18
6			1·87	42	2·28	68	2·95	108	1·4	24	1·4	24
7			1·8	41	2·3	69	2·7	93	1·4	24	1·4	24
8			1·95	49	2·3	69	2·55	84	1·3	20	1·4	24
9			2·75	96	2·35	72	2·47	79	1·3	20	1·4	24
10			3·4	136	2·32	70	2·42	76	1·3	20	1·2	16
11			3·75	160	2·2	63	2·3	69	1·25	18	1·2	16
12			3·95	175	2·35	72	2·2	63	1·27	19	1·2	16
13			4·0	179	2·3	69	2·2	63	1·35	22	1·2	16
14			3·9	172	2·2	63	2·45	78	1·32	21	1·2	16
15			3·7	157	2·2	63	2·5	81	1·3	20	1·4	24
16			3·7	157	2·2	63	2·6	87	1·3	20	1·35	22
17			3·85	167	2·1	57	2·5	81	1·35	22	1·2	16
18			3·9	172	2·07	55	2·5	81	1·55	30	1·2	16
19			3·85	167	2·1	57	2·3	69	1·8	41	1·2	16
20			3·75	160	2·1	57	2·1	57	1·67	35	1·2	16
21			3·7	157	2·2	63	2·02	52	1·6	32	1·2	16
22			3·55	147	2·3	69	1·87	14	1·55	30	1·2	16
23			3·45	140	2·3	69	1·67	35	1·5	28	1·2	16
24			3·4	136	2·3	69	1·6	32	1·5	28	1·2	16
25	2·6	87	3·4	136	2·45	78	1·6	32	1·4	24	1·2	16
26	2·6	87	3·4	136	2·85	102	1·6	32	1·32	21	1·2	16
27	2·57	85	3·4	136	3·35	133	1·65	34	1·25	18	1·2	16
28	2·45	78	3·4	136	3·8	164	1·7	36	1·25	18	1·2	16
29	2·2	63	3·3	129	4·65	230	1·6	32	1·27	19	1·2	16
30	2·2	63	3·25	126	4·27	198	1·55	30	1·27	19		..
31			3·05	114			1·5	28	1·25	18		..

HAT CREEK AT HAT CREEK RANCH (NEAR ASHCROFT, B.C.).

Location.—Section 21, township 22, range 25, west 6th meridian, just above the crossing of the Cariboo road, Mile 12.

Records Available.—May 9 to August 16, 1911; April 25 to August 2, 1912; April 26 to September 30, 1913.

Winter Conditions.—Very short spells of severe cold; snowfall very light.

Gauge.—The gauge is a 4-foot staff nailed to a small tree near the Lillooet road, a short distance above the Hat Creek ranch. Readings were obtained daily by Thos. Brennan, during the irrigation season.

Channel.—The channel is straight for 30 or 40 feet above and below the gauge. Water is fairly swift, and there is a possibility that large freshets might cause a shifting of the stream bed.

Accuracy.—The stream was well rated during 1913, and the accuracy of returns for 1913 is high.

Discharge Measurements of Hat Creek, at Hat Creek Ranch, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
April 26	C. G. Cline	1,055	25	26·3	1·32	2·21	34·8
May 22	K. G. Chisholm	1,055	25	45·6	2·34	2·98	107·4
May 23	do	1,055	25	46·4	2·45	3·03	113·7
May 25	do	1,055	25	53·8	2·95	3·51	158·8
May 29	do	1,055	25	53·8	3·12	3·53	167·2
Aug. 1	do	1,055	24	21·4	0·88	1·99	18·8

Monthly Discharge of Hat Creek at Hat Creek Ranch for 1913.

(Drainage Area 240 square miles).

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	203	21	94·7	0·39	0·45	5,823
June	192	70	120·1	0·50	0·56	7,146
July	135	15	61·2	0·25	0·29	3,763
August	43	15	25·7	0·11	0·13	1,580
September	21	15	17·6	0·07	0·08	1,048

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Daily Gauge Heights and Discharges of Hat Creek at Hat Creek for 1913.

Day.	April.		May.		June.		July.		August.		September.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	2·1	28	3·5	161	3·25	135	2·1	28	1·92	17
2	.....	.....	2·1	28	3·6	171	3·15	125	2·1	28	1·92	17
3	.....	.....	2·1	28	3·6	171	3·05	115	2·15	31	1·92	17
4	.....	.....	2·1	28	3·5	161	2·95	105	2·15	31	1·92	17
5	.....	.....	2·0	21	3·3	141	2·9	100	2·1	28	1·92	17
6	.....	.....	2·0	21	3·15	125	2·8	89	2·1	28	1·92	17
7	.....	.....	2·1	28	3·05	115	2·9	100	2·1	28	1·92	17
8	.....	.....	2·1	28	3·05	115	2·8	89	2·05	24	1·92	17
9	.....	.....	2·7	79	3·1	120	2·7	79	2·05	24	1·92	17
10	.....	.....	3·2	1·30	3·15	125	2·75	85	2·0	21	1·92	17
11	.....	.....	3·0	1·10	3·1	120	2·6	70	2·0	21	1·9	15
12	.....	.....	2·9	1·00	3·0	110	2·6	70	2·0	21	1·92	17
13	.....	.....	2·8	0·89	2·95	105	2·7	79	1·95	18	1·95	18
14	.....	.....	2·7	0·79	2·85	95	2·7	79	1·95	18	2·00	21
15	.....	.....	2·7	0·79	2·8	89	2·6	70	1·9	15	1·95	18
16	.....	.....	2·7	0·79	2·7	79	2·55	65	1·9	15	1·95	18
17	.....	.....	2·7	0·79	2·65	74	2·5	60	1·9	15	1·92	17
18	.....	.....	2·6	0·70	2·6	70	2·25	39	1·92	17	1·92	17
19	.....	.....	2·6	0·70	2·65	74	2·3	43	2·0	21	1·92	17
20	.....	.....	2·8	0·89	3·0	110	2·25	39	2·1	28	1·92	17
21	.....	.....	2·9	1·00	2·85	95	2·2	35	2·15	31	1·92	17
22	.....	.....	3·0	1·10	2·8	89	2·15	31	2·2	35	1·92	17
23	.....	.....	3·1	1·20	2·7	79	2·1	28	2·25	39	2·0	21
24	.....	.....	3·3	1·41	2·8	89	2·05	24	2·3	43	2·0	21
25	.....	.....	3·5	1·61	2·95	1·05	2·0	21	2·25	39	1·95	18
26	2·2	35	3·7	1·82	3·25	1·35	1·95	18	2·25	39	1·95	18
27	2·2	35	3·9	2·03	3·8	1·92	1·9	15	2·22	37	1·95	18
28	2·2	35	3·8	1·92	3·7	1·82	1·95	18	2·02	23	1·95	18
29	2·1	28	3·6	1·71	3·5	1·61	2·05	24	1·92	17	1·95	18
30	2·1	28	3·4	1·51	3·35	1·46	2·05	24	1·92	17	1·95	18
31	2·1	28	3·3	1·41	.....	.....	2·05	24	1·92	17	1·95	18

HAT CREEK (UPPER STATION).

Location.—Section 18, township 19, range 26, west 6th meridian at Colley's ranch, just above the Hammond diversion.

Records Available.—April 22, 1911, to December 31, 1911; January 1, 1912, to November 18, 1912; April 30, 1913, to December, 1913.

Winter Conditions.—Stream frequently open during winter months. Snowfall is about 4 feet per annum, while the mean annual rainfall is probably about 10 to 12 inches, making the total annual precipitation 14 inches to 16 inches.

Gauge.—A Standard vertical staff gauge is used, which is read daily by Thos. King.

Channel.—The channel is 12 to 14 feet in width, and is straight above and below the gauge. The control is good.

Discharge Measurements.—Well-distributed measurements have been obtained covering the stream's range. Meterings are made in the box flume above the Hammond diversion weir.

Accuracy.—Conditions for metering are good, and gauge readings were carefully taken. Accuracy is fairly high (within 10 per cent).

HAT CREEK.

Hat creek is an important and contentious irrigation stream in the Dry Belt of British Columbia. It rises in the hills about 15 miles west of Ashcroft, in the Hat Creek forest reserve, at an elevation of about 4,300 feet; and after flowing northerly for nearly 40 miles discharges into Bonaparte River from the west, about 14 miles from Ashcroft, at an elevation of about 2,000 feet.

It is part of the Bonaparte-Thompson drainage. The drainage area of Hat creek above the mouth is about 240 square miles, and above the Hammond diversion is about 47 square miles.

The creek varies in width from 15 to 20 feet, and is from 1 to 3 feet deep.

The precipitation at the mouth is only about from 9 inches to 10 inches, while at Upper Hat creek it probably is from 10 inches to 12 inches.

The summers are quite hot and generally dry, the evenings being cool. The winters are long and severe. The snowfall in Upper Hat creek is about 4 feet, but is less near the mouth.

Hat Creek valley is mostly timbered with bull pine, poplar, and some willow, with a few open patches of land.

The hills are mostly open range lands, or timbered with bull pine, jack pine, spruce, and fir.

The valley varies in width from 1 mile to several hundred yards. The hills in the upper part of the watershed rise to a height of 5,000 feet above the sea.

The upper bench lands, owing to their elevation above Hat creek, cannot be irrigated from the main stream, and several of the small tributaries are used, but the supply of water is not sufficient to give promise of much future development.

In the valley there are a number of good farms and ranches, all requiring irrigation. The soil is mostly a sandy loam with sandy and gravelly subsoil. Near the lower part of the valley, fruit is successfully grown, but in the upper valley of Hat creek, ranching and mixed farming must be resorted to.

Hat Creek ranch, at the mouth of Hat Creek, uses water for irrigation. Water is also used by Robertson Duck (Chinaman), Parke, Darragh, Smith, Pocock, and King, while the Indians in the lower valley use a little. In Upper Hat creek the growing season is short, and not as much water is necessary as near the mouth.

Exclusive of several water records on small tributaries, there is a total of 8,450 miners inches (237 c.f.s.) recorded on Hat creek. Many of these records, appurtenant to land, in Bonaparte valley, have never been used, nor probably will be, owing to impracticability and the heavy expense involved in the construction of the necessary irrigation works. It is probable that many of these old records will be cancelled by the British Columbia Board of Investigation.

There are also several water records allowing the diversion of water from Upper Hat creek into the Oregon Jack creek divide, for use on lands near Ashcroft.

Mr. W. H. Hammond, who owns the Basque ranch, holds the Minnaberriet and Langley records for about 600 miner's inches, dated 1871 and 1883, and diverts water from Upper Hat creek at Colley's homestead. His canal is about 2 miles long, and delivers the water into Oregon Jack creek divide reservoir site, whence it gradually seeps into Oregon Jack creek and down that stream to Hammond's ditch to Basque ranch. There is considerable water lost through seepage, percolation and evaporation in the swampy reservoir.

The Ashcroft Water, Electric and Improvement Company also holds a record from Upper Hat creek for 1,000 miner's inches, dated 1906, allowing the diversion of the surplus waters of Hat creek, said waters to be stored in the same Oregon Jack Creek divide reservoir, then taken down Oregon Jack creek to be used on certain lands west and north of Ashcroft.

This record has never been operated, and there is a dispute between this company and the owner of the Basque ranch regarding the rights to use the Oregon Jack creek divide reservoir.

The company proposes to construct large storage works, dams, etc., sufficient to store from 8,000 to 10,000 acre-feet.

The dispute between the two rival holders will have to be settled by the British Columbia Board of Investigation. In the meantime the reservoir, which is Dominion land, has not been granted to either applicant.

Hat creek has many small tributaries, viz: (from the left going upstream) Boundary, Parks, Cattle, Medicine, and Blue-earth creeks; (from the right going upstream) Graves, Anderson, Pocock, King, and Colley creeks. Miscellaneous measurements of discharge have been taken on several of these tributaries.

At the head of Blue-earth creek, which enters above Hammond's diversion, is a small storage lake, Blue-earth lake. For details of Blue-earth reservoir see "Blue-earth creek".

There have been several hydrographic stations established on Hat creek, viz: Hat creek (at Colley's ranch), Hammond's ditch, and Hat creek (at Hat Creek ranch) near mouth.

Measurements were also made at Hat Creek ranch, showing the quantity of water used there for irrigation.

Measurements were taken to find the loss in the Hammond ditch between the intake and the reservoir in Oregon Jack divide.

DISCHARGE MEASUREMENTS of Hat Creek, above Hammond's Ditch 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
April 28	Cline & Chisholm	1,055	11·5	5·4	1·18	0·25	6·2
Aug. 3	K. G. Chisholm	1,055	9·0	5·2	1·00	0·24	5·4

MONTHLY DISCHARGE of Hat Creek, above Hammond's Ditch for 1913.

(Drainage area, 47 square miles).

Month.	Discharge in Second-Feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	49·0	5·0	25·4	0·54	0·62	1,562
June	42·0	15·0	23·1	0·49	0·55	1,368
July	24·5	6·7	14·1	0·30	0·35	867
August	10·5	6·0	7·2	0·15	0·17	443
September	5·0	4·2	4·7	0·10	0·11	280
October	10·5	3·7	4·4	0·09	0·10	270
November	3·7	2·5	3·4	0·07	0·08	202
December	3·7	2·5	2·9	0·06	0·07	183

Daily Gauge Heights and Discharges of Hat Creek above Hammond's Ditch for 1913.

Day.	April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	0·25	6·7	0·95	41·8
2	.....	.....	0·19	4·8	0·85	35·5
3	.....	.....	0·23	6·0	0·95	41·8
4	.....	.....	0·21	5·3	0·85	35·5
5	.....	.....	0·25	6·7	0·75	29·7
6	.....	.....	0·23	6·0	0·65	24·5
7	.....	.....	0·40	12·5	0·65	24·5
8	.....	.....	0·25	6·7	0·60	22·0
9	.....	.....	0·85	35·5	0·55	19·5
10	.....	.....	0·85	35·5	0·60	22·0
11	.....	.....	0·75	29·7	0·55	19·5
12	.....	.....	0·65	24·5	0·45	14·7
13	.....	.....	0·65	24·5	0·45	14·7
14	.....	.....	6·00	22·0	0·45	14·7
15	.....	.....	0·65	24·5	0·45	14·7
16	.....	.....	0·55	19·5	0·45	14·7
17	.....	.....	0·60	22·0	0·45	14·7
18	.....	.....	0·55	19·5	0·45	14·7
19	.....	.....	0·65	24·5	0·55	19·5
20	.....	.....	0·75	29·7	0·55	19·7
21	.....	.....	0·60	22·0	0·45	14·5
22	.....	.....	0·85	35·5	0·50	17·0
23	.....	.....	0·75	29·7	0·45	14·7
24	.....	.....	0·95	41·8	0·55	19·5
25	.....	.....	0·85	35·5	0·55	19·5
26	.....	.....	1·05	48·7	0·45	24·5
27	.....	.....	0·95	41·8	0·85	35·5
28	.....	.....	10·5	48·7	0·75	29·7
29	0·25	6·7	0·95	41·8	0·75	29·7
30	0·15	3·7	0·95	41·8	0·75	29·7
31	.....	.....	.....	35·5	.....	.....

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DAILY GAUGE HEIGHTS AND DISCHARGES of Hat Creek above Hammonds Ditch for 1913.—*Continued.*

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Fect.	Sec.-ft.
1	0·65	24·5	0·29	8·1	0·20	5	0·16	4·0	0·15	3·7	0·15	3·7
2	0·60	22·0	0·25	6·7	0·20	5·0	0·16	4·0	0·15	3·7	0·15	3·7
3	0·55	19·5	0·25	6·7	0·20	5·0	0·16	4·0	0·15	3·7	0·15	3·7
4	0·55	19·5	0·25	6·7	0·20	5·0	0·16	4·0	0·15	3·7	0·15	3·7
5	0·55	19·5	0·25	6·7	0·20	5·0	0·16	4·0	0·15	3·7	0·15	3·7
6	0·55	19·5	0·25	6·7	0·20	5·0	0·16	4·0	0·15	3·7	0·15	3·7
7	0·55	19·5	0·25	6·7	0·20	5·0	0·16	4·0	0·15	3·7	0·15	3·7
8	0·53	18·5	0·25	6·7	0·20	5·0	0·16	4·0	0·15	3·7	0·15	3·7
9	0·50	17·0	0·25	6·7	0·20	5·0	0·16	4·0	0·15	3·7	0·15	3·7
10	0·55	19·5	0·25	6·7	0·20	5·0	0·16	4·0	0·15	3·7	0·15	3·7
11	0·50	17·0	0·25	6·7	0·20	5·0	0·16	4·0	0·15	3·7	0·15	3·7
12	0·45	14·7	0·25	6·7	0·20	5·0	0·16	4·0	0·15	3·7	0·15	3·7
13	0·45	14·7	0·25	6·7	0·20	5·0	0·25	6·7	0·15	3·7	0·10	2·5
14	0·45	14·7	0·25	6·7	0·20	5·0	0·35	10·5	0·15	3·7	0·10	2·5
15	0·43	13·8	0·28	7·8	0·20	5·0	0·15	3·7	0·15	3·7	0·10	2·5
16	0·45	14·7	0·29	8·1	0·17	4·2	0·15	3·7	0·15	3·7	0·10	2·5
17	0·40	12·5	0·33	9·7	0·17	4·2	0·15	3·7	0·15	3·7	0·10	2·5
18	0·43	13·8	0·35	1·05	0·17	4·2	0·25	6·7	0·15	3·7	0·10	2·5
19	0·39	12·1	0·35	1·05	0·17	4·2	0·25	6·7	0·15	3·7	0·10	2·5
20	0·40	12·5	0·30	8·5	0·17	4·2	0·25	6·7	0·15	3·7	0·10	2·5
21	0·35	10·5	0·30	8·5	0·17	4·2	0·15	3·7	0·15	3·7	0·10	2·5
22	0·35	10·5	0·25	6·7	0·18	4·5	0·15	3·7	0·15	3·7	0·10	2·5
23	0·33	9·7	0·25	6·7	0·18	4·5	0·15	3·7	0·10	2·5	0·10	2·5
24	0·33	9·7	0·25	6·7	0·18	4·5	0·15	3·7	0·10	2·5	0·10	2·5
25	0·35	10·5	0·25	6·7	0·18	4·2	0·15	3·7	0·10	2·5	0·10	2·5
26	0·33	9·7	0·25	6·7	0·18	4·5	0·15	3·7	0·10	2·5	0·10	2·5
27	0·30	8·5	0·25	6·7	0·18	4·5	0·15	3·7	0·10	2·5	0·10	2·5
28	0·27	7·4	0·23	6·0	0·18	4·5	0·15	3·7	0·10	2·5	0·10	2·5
29	0·25	6·7	0·23	6·0	0·17	4·2	0·15	3·7	0·10	2·5	0·10	2·5
30	0·25	6·7	0·23	6·0	0·17	4·2	0·15	3·7	0·10	2·5	0·10	2·5
31	0·25	6·7	0·23	6·0	.....	.....	0·15	3·7	.....	.....	0·10	2·5

HAT CREEK (HAMMOND'S DIVERSION.)

Location.—Section 17, township 19, range 26, west 6th meridian.

Records Available.—Computed indirectly during 1911 (irrigation season); May 8 to August 25, 1912; May 28 to September 28, 1913.

Winter Conditions.—Snowfall about 4 feet in winter months. Water in ditch only during irrigation season.

Gauge.—Vertical staff gauge, read daily during irrigation period by Thos. King.

Channel.—Ditch is about 6 feet wide and 2 feet deep, with a carrying capacity of about 20 second-feet The loss by seepage in the gravelly portions is considerable, as well as in the timber fluming.

Discharge Measurements.—The rating curve is well defined, frequent meterings having been made.

Accuracy.—Accuracy of returns appended is high, and are considered to be within 10 per cent of conditions actually obtaining.

HAT CREEK (IN HAMMOND'S DITCH.)

Hammond's ditch diverts water from Upper Hat creek at Colley's ranch, about 22nd mile from the mouth of the stream. It discharges the water into a large swampy reservoir in the divide between Hat creek and Oregon Jack creek, whence the water runs into Oregon Jack creek, and is used for irrigation

on the Basque ranch, southwest of Ashcroft in the Thompson drainage area. A large quantity of the water diverted by Hammond's ditch is lost by seepage and evaporation in the so-called reservoir before it reaches Oregon Jack creek.

The ditch is nearly 2 miles long. It is mostly side-hill ditch,with several lengths of timber fluming. It runs along the lower contour of the hills to the south of the divide. The ditch is about 6 feet wide and 2 feet deep. It has a maximum capacity of about 20 c.f.s. The greatest quantity that has yet been diverted at any time is 14 c.f.s., the mean velocity being only 1.5 feet per second.

A regular gauging station was established in Hammond's ditch on May 9, 1912, and the readings were taken after the headgate was closed on August 26; also during season of 1913.

The gauge is a vertical staff fastened to the side of the overflow spillway, about 10 feet below the overflow sluiceway, and 100 yards below the intake. The zero of the gauge is referred to one bench-mark.

The meter measurements were made in the spillway box, by means of a current-meter attached to a wading rod.

In 1911, the amount of water diverted was computed from the difference between the daily discharges recorded by the upper and lower gauges at the gauging station at Colley's ranch.

MONTHLY DISCHARGE of Hammond's Ditch at Head Gates for 1913.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
May	12·1	0·0	1·6	96
June	14·3	9·9	11·1	660
July	11·0	5·8	8·6	531
August	5·8	2·8	5·3	324
September	4·6	0·0	3·3	196
Total quantity diverted				1,807

DISCHARGE MEASUREMENTS of Hammond's Ditch at Head Gates for 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Aug. 3	K. G. Chisholm	1055	5·5	4·2	1·21	0·78	5·08
" 3	do	1055	5·5	3·52	0·93	0·56	3·26
" 3	do	1053	5·5	2·93	0·80	0·47	2·33
" 3	do	1055				0·18	0·0

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Daily Gauge Heights and Discharges of Hat Creek in Hammonds Ditch at Head Gates for 1913.

Day.	May.		June.		July.		August.		September.	
	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	...	...	1·08	12·1	0·98	9·9	0·78	5·8	0·58	2·8
2	...	...	1·08	12·1	0·98	9·9	0·78	5·8	0·63	3·3
3	...	...	1·18	14·3	1·03	11·0	0·78	5·8	0·68	4·1
4	...	...	1·18	14·3	0·93	8·6	0·78	5·8	0·63	3·3
5	...	...	1·08	12·1	0·98	9·9	0·78	5·8	0·68	4·1
6	...	...	1·08	12·1	0·98	9·9	0·78	5·8	0·68	4·1
7	...	...	1·08	12·1	0·98	9·9	0·78	5·8	0·71	4·6
8	...	...	1·08	12·1	0·98	9·9	0·78	5·8	0·68	4·1
9	...	...	1·08	12·1	1·03	11·0	0·78	5·8	0·68	4·1
10	...	...	1·08	12·1	0·98	9·9	0·76	5·7	0·68	4·1
11	...	...	0·98	9·9	0·98	9·9	0·73	4·9	0·68	4·1
12	...	...	1·03	11·0	0·98	9·9	0·73	4·9	0·68	4·1
13	...	...	1·08	12·1	0·98	9·9	0·73	4·9	0·68	4·1
14	...	...	0·98	9·9	0·96	9·5	0·73	4·9	0·68	4·1
15	...	...	1·03	11·0	0·94	9·0	0·73	4·9	0·66	3·8
16	...	...	0·98	9·9	0·98	9·9	0·78	5·8	0·66	3·8
17	...	...	1·03	11·0	0·96	9·5	0·78	5·8	0·63	3·3
18	...	...	0·98	9·9	0·93	8·6	0·78	5·8	0·63	3·3
19	...	...	0·98	9·9	0·94	9·0	0·78	5·8	0·63	3·3
20	...	...	0·98	9·9	0·93	8·6	0·78	5·8	0·63	3·3
21	...	...	1·03	11·0	0·88	7·8	0·78	5·8	0·63	3·3
22	...	...	1·03	11·0	0·88	7·8	0·78	5·8	0·63	3·3
23	...	...	0·98	9·9	0·88	7·8	0·78	5·8	0·63	3·3
24	...	...	1·03	11·0	0·83	6·8	0·78	5·8	0·63	3·3
25	...	...	0·98	9·9	0·88	7·8	0·78	5·8	0·63	3·3
26	...	...	0·98	9·9	0·83	6·8	0·73	4·9	0·63	3·3
27	...	...	0·98	9·9	0·78	5·0	0·68	4·1	0·63	3·3
28	1·08	12·1	1·03	11·0	0·78	5·8	0·68	4·1	.....	.....
29	1·08	12·1	1·03	11·0	0·78	5·8	0·64	3·5	.....	.....
30	1·08	12·1	0·98	9·9	0·82	6·4	0·63	3·3	.....	.....
31	1·08	12·1	.....	.....	0·78	5·8	0·58	2·8	.....	.....

HEFFERLY CREEK (LOWER STATION)

Location.—Section 11, township 22, range 17, west 6th meridian.

Records Available.—August 19, 1911, to October 31, 1911; April 3, 1912, to September 15, 1912; April 13, 1913, to September 15, 1913.

Winter Conditions.—Stream is usually frozen over during winter months.

Gauge.—Vertical staff gauge, read daily by J. W. Austin.

Channel.—The channel is about 15 feet in width and the bed rocky. The flow varies from a minimum of zero to a maximum of 100 cubic feet per second. The flow is partly subject to artificial regulation by a dam on Hefferly lake.

Discharge Measurements.—The stream is well rated except for a very short period at the peak of the freshet.

Accuracy.—The accuracy of returns is high (within 5 per cent).

HEFFERLY CREEK.

Hefferly creek has its source in Hefferly lake, near the divide into Louis creek, at an elevation of 3,100 feet and, flowing westerly, empties into North Thompson river, near Hefferly creek post office (about 14 miles from Kamloops), at an elevation of 1,150 feet. The stream is about 10 miles long, from 15 to 25 feet wide, and from 6 inches to 2 feet deep. Hefferly lake is about 2 miles long and several hundred yards wide, and is used as a storage reservoir for irrigation purposes. The water users have co-operated and constructed a small dam at the outlet of the lake, and the spring freshet is mostly

conserved. It is not possible to greatly increase the capacity of the reservoir without damming the easterly end of the lake as well, on account of the low divide into Louis creek.

Hefferly creek, like so many of the streams in the dry belt, is vastly over-recorded for irrigation purposes, but by storage and careful use there is enough water for all the lands in the valley and at the mouth. The earliest records are apurtenant to the Austen and Anderson places, near the mouth of the creek, and the waters of the creek are used mostly on these lowlands. The Anderson interests have recently been formed into the North Thompson Ranching Company, and it is proposed to construct a high line canal, beginning near the lake, and irrigate several thousand acres of sloping bench lands on the south side of the Hefferly valley. Austen owns a large tract of land at the mouth of the creek, and has purchased some of Anderson's bottom lands. There are several small farms in the valley, but they depend on the water that is not required by Anderson and Austen.

The hills of the Hefferly drainage rise to a height of 4,000 feet, and are fairly well covered with timber, bull pine, jack pine, and some fir. The upper slopes are excellent range lands.

The precipitation of Hefferly drainage is probably about 20 inches, near the headwaters, which rise near Louis creek and the easterly limit of the dry belt. At the mouth of the creek the precipitation is not more than 10 inches per annum. with only a small rainfall during the growing season.

Hefferly Creek, below Hefferly Lake.

This gauging station is a combination of three stations, viz: Hefferly creek, upper station, Anderson's diversion, and Crawshaws ditch (No. 239). These three stations were established on June 25, 1911, by C. G. Cline, and gauge readings were taken during the irrigation season of 1911 and 1912. The object of the three stations was to measure the amount of water used by each ditch, and by combining all three to obtain the total flow of the creek coming from Hefferly lake. Moreover, it was difficult to obtain a gauge reader for a station above Anderson intake.

A vertical staff gauge was placed at each station, and the datum of each was referred to three bench-marks.

The data of discharge here given were obtained, as has been stated, by combining the flow of all three stations. The quantity of water running in the Anderson and Crawshaw ditches is also published.

Hefferly Creek, at mouth.

This station was established on August 19, 1911, by C. G. Cline. It is located above Austen's diversion, near the mouth of the creek, about 100 yards upstream from the Hefferly Creek bridge, and 40 feet from the road. The gauge is a vertical staff, 5 feet long, and is nailed to a fallen fir tree on the left bank of the creek. The datum of the gauge is referred to three bench-marks. The banks are from 3 to 5 feet high, and do not overflow at high water. Measurements are made with a current-meter by the wading method, at a section about 100 feet below the gauge, This station shows the total flow of Hefferly creek, except that which is used by Anderson and Crawshaw, and includes the flow of Edwards creek. Hefferly creek below the Austen headgates is dry during the irrigation season, as nearly all the water is used.

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Discharge Measurements of Hefferly Creek at Lower Station, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
June 25	H. J. E. Keys	1,057	13	10·1	1·04	1·32	10·5

Monthly Discharge of Hefferly Creek at Lower Station for 1913.

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April	20·7	7·5	10	0·15	0·17	590
May	28·5	8·9	17·3	0·26	0·30	1,060
June	16·1	7·5	10·5	0·16	0·18	625
July	12·9	3·3	7·3	0·11	0·13	450
August	11·0	2·0	6·9	0·11	0·13	420

Note.—Accuracy "A".

Daily Gauge Heights and Discharges of Hefferly Creek at Lower Station for 1913.

Day.	April.		May.		June.		July.		August.		September.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			1·35	12·1	1·4	14·0	1·35	12·1	1·0	3·3	1·25	
2			1·3	10·3	1·4	14·0	1·35	12·1	1·0	3·3	1·27	
3			1·25	8·9	1·4	14·0	1·3	10·3	0·97	2·9	1·3	
4			1·25	8·9	1·3	10·3	1·3	10·3	0·95	2·6	1·32	
5			1·25	8·9	1·3	10·3	1·3	10·3	0·90	2·0	1·30	
6			1·25	8·9	1·3	10·3	1·3	10·3	0·92	2·6	1·27	
7			1·25	8·9	1·3	10·3	1·2	7·5	1·2	7·5	1·22	
8			1·25	8·9	1·3	10·3	1·15	6·3	1·32	11·0	1·25	
9			1·4	14·0	1·3	10·3	1·15	6·3	1·3	10·3	1·25	
10			1·7	28·5	1·2	7·5	1·15	6·3	1·25	8·9	1·25	
11			1·65	25·8	1·2	7·5	1·15	6·3	1·22	8·1	1·25	
12			1·7	28·5	1·2	7·5	1·17	6·8	1·27	9·5	1·25	
13	1·3	10·3	1·6	23·2	1·2	7·5	1·22	8·1	1·27	9·5	1·25	
14	1·2	7·5	1·6	23·2	1·2	7·5	1·32	11·0	1·25	8·9	1·22	
15	1·2	7·5	1·6	23·2	1·2	7·5	1·37	12·9	1·27	9·5	1·2	
16	1·3	10·3	1·55	20·7	1·2	7·5	1·32	11·0	1·25	8·9		
17	1·3	10·3	1·55	20·7	1·2	7·5	1·27	9·5	1·2	7·5		
18	1·4	14·0	1·55	20·7	1·2	7·5	1·22	8·1	1·2	7·5		
19	1·5	18·2	1·55	20·7	1·2	7·5	1·2	7·5	1·2	7·5		
20	1·5	18·2	1·5	18·2	1·2	7·5	1·15	6·3	1·2	7·5		
21	1·55	20·7	1·5	18·2	1·2	7·5	1·15	6·3	1·2	7·5		
22	1·5	18·2	1·5	18·2	1·35	12·1	1·12	5·6	1·2	7·5		
23	1·4	14·0	1·5	18·2	1·4	14·0	1·07	4·6	1·17	6·8		
24	1·4	14·0	1·5	18·2	1·4	14·0	1·05	4·2	1·17	6·8		
25	1·4	14·0	1·5	18·2	1·35	12·1	1·02	3·7	1·15	6·3		
26	1·4	14·0	1·5	18·2	1·35	12·1	1·05	4·2	1·15	6·3		
27	1·35	12·1	1·5	18·2	1·45	16·1	1·02	3·7	1·15	6·3		
28	1·35	12·1	1·5	18·2	1·4	14·0	1·05	4·2	1·15	6·3		
29	1·35	12·1	1·45	16·1	1·4	14·0	1·05	4·2	1·15	6·3		
30	1·35	12·1	1·45	16·1	1·35	12·1	1·05	4·2	1·15	6·3		
31			1·45	16·1			1·05	3·3	1·25	8·9		

HEFFERLY CREEK BELOW HEFFERLY LAKE.

Location.—Section 3, township 22, range 16, west 6th meridian.

Records Available.—June 25 to November 30, 1911; April 1 to September 20, 1912; May 11 to September 19, 1913.

Winter Conditions.—Climatic conditions are somewhat similar to those at Kamloops, except for the fact that owing to the greater altitude of the drainage basin of Hefferly Creek, the winter is slightly longer and the precipitation (rainfall and snowfall) more excessive.

Gauges.—The flow out of Hefferly lake is arrived at by the summation of flow of Anderson's ditch, Crawshaw's ditch and Hefferly creek below these two diversions which take water from the creek (during the irrigation season) below the lake and above the hydrographic survey gauge. During the coming season the flow out of Hefferly lake will be directly measured. Mr. F. S. Lawrence acts as gauge reader. The three gauges are standard vertical staff gauges.

Channel.—Channel is about 10 to 15 feet in width, gradient is steep, and control good. During extreme high water trouble has been met with owing to backwater from the highway bridge. This was however of very short duration and results were not appreciably effected.

The channel of the Anderson ditch is very gravelly, and there is much loss by seepage.

Discharge Measurements.—Eight well distributed measurements were made on the stream during 1911-12-13.

Accuracy.—Gauge readings were accurate, and conditions excellent at the regular station, but poor conditions existed for current-meter work on the Anderson and Crawshaw ditches. Accuracy on the whole is only fair during the irrigation season, but high during that period when no diversion was being made.

DISCHARGE MEASUREMENTS of Anderson diversion of Hefferly Creek near Lawrence Ranch, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
June 26	H. J. Keyes	1,057	7	4·06	1·3	1·18	5·25

MONTHLY DISCHARGE of Crawshaw Ditch for 1913.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
May	2·6	0·0	1·3	80
June	3·5	1·4	2·9	173
July	3·5	0·0	0·9	55
August	3·5	0·0	0·7	43

NOTE.—Total water diverted in 1913 = 351 acre-feet.

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Monthly Discharge of Anderson's ditch near Lawrence's Ranch, Upper Station for 1913.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
May	6·5	0·0	3·5	215
June	8·4	1·1	6·5	387
July	4·3	1·0	2·6	160
August	5·7	3·3	4·3	264
September	5·0	0·0	2·1	125

Note.—Total amount of water diverted in 1913 = 1,151 acre-feet.

Monthly Discharge of Hefferly Creek below Hefferly Lake for 1913.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
May	9·2	4·4	6·3	387
June	9·2	5·1	7·05	419
July	3·7	1·0	2·07	127
August	23·2	1·4	10·7	658
September	17·9	0·5	10·5	625

Note.—The drainage area is not used in this table because there is a diversion above the station.

Monthly Discharge of Hefferly Creek. Total flow below Hefferly Lake for 1913.

(Drainage Area 30 Square Miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May			11·1	0·37	·43	682
June			16·5	0·55	·61	982
July			5·6	0·19	·22	344
August			15·7	0·52	·60	965

Note.—These figures are the sum of the flow in the creek below two diversions and the two diversions themselves and give the actual flow from Hefferly lake.

Daily Gauge Heights and Discharges of Hefferly Creek at Anderson's Ditch for 1913.

Day.	May.		June.		July.		August.		September.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	1·25	6·5	0·75	1·0	.....	3·3	1·1	4·3
2	.....	.....	1·25	6·5	0·75	1·0	1·0	3·0	1·1	4·3
3	.....	.....	1·25	6·5	0·75	1·0	.....	3·3	1·1	4·3
4	.....	.....	1·25	6·5	0·75	1·0	1·05	3·6	1·15	5·0
5	.....	.....	1·3	7·4	0·8	1·2	1·05	3·6	1·15	5·0
6	.....	.....	.....	7·4	0·8	1·2	1·05	3·6	1·1	4·3
7	.....	.....	1·3	7·4	.....	1·6	1·2	5·7	1·05	3·6
8	.....	.....	1·3	7·4	0·9	2·0	.....	5·4	1·05	3·6
9	.....	.....	1·3	7·4	.....	2·5	1·15	5·0	1·05	3·6
10	.....	.....	1·3	7·4	1·0	3·0	1·15	5·0	1·05	3·6
11	1·1	4·3	1·3	7·4	0·95	2·5	1·1	4·3	1·05	3·6
12	.....	4·3	1·3	7·4	0·95	2·5	1·15	5·0	1·05	3·6
13	1·1	4·3	1·3	7·4	0·95	2·5	1·1	4·3	1·05	3·6
14	.....	4·3	1·3	7·4	1·0	3·0	.....	4·7	1·05	3·6
15	1·1	4·3	.....	7·9	1·05	3·6	1·15	5·0	1·05	3·6
16	1·1	4·3	1·35	8·4	1·0	3·0	1·1	4·3	1·0	3·0
17	1·05	3·6	1·35	8·4	1·0	3·0	.....	4·3	0·7	0·9
18	1·05	3·6	1·3	7·4	1·0	3·0	1·1	4·3	0·6	0·8
19	1·1	4·3	1·35	8·4	1·0	3·0	1·1	4·3	0·6	0·8
20	1·1	4·3	1·3	7·4	.....	3·0	1·1	4·3	.....	.....
21	.....	5·0	1·35	8·4	1·0	3·0	1·1	4·3	.....	.....
22	1·2	5·7	1·35	8·4	1·0	3·0	1·1	4·3	.....	.....
23	1·2	5·7	1·35	8·4	1·0	3·0	1·1	4·3	.....	.....
24	1·2	5·7	.....	7·9	.....	2·8	.....	4·3	.....	.....
25	1·25	6·5	1·3	7·4	0·95	2·5	1·1	4·3	.....	.....
26	1·25	6·5	0·9	2·0	.....	2·6	1·1	4·3	.....	.....
27	.....	6·1	0·8	1·2	.....	2·8	1·1	4·3	.....	.....
28	1·2	5·7	0·8	1·2	1·0	3·0	.....	4·3	.....	.....
29	1·25	6·5	.....	1·1	.....	3·6	.....	4·3	.....	.....
30	1·25	6·5	.....	1·1	1·1	4·3	.....	4·3	.....	.....
31	1·25	6·5	.....	.....	1·05	3·6	.....	4·3	.....	.....

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Daily Gauge Heights and Discharges of Hefferly Creek at Upper Station for 1913.

Day.	May.		June.		July.		August.		September.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			1·2	5·7	1·2	5·7		1·8	1·5	17·9
2			1·3	9·2	1·15	4·4	1·05	2·2	1·5	17·9
3			1·25	7·4	1·15	4·4		1·8	1·45	15·6
4			1·2	5·7	1·15	4·4	1·0	1·4	1·5	17·9
5			1·25	7·4	1·1	3·1	1·0	1·4	1·45	15·6
6				8·3	1·1	3·1	1·0	1·4	1·4	13·2
7			1·3	9·2	1·05	2·2	1·45	15·6	1·4	13·2
8			1·3	9·2	1·0	1·4	1·6	23·2	1·4	13·2
9			1·3	9·2	0·95	1·0	1·55	20·5	1·35	11·2
10			1·2	5·7	0·95	1·0	1·5	17·9	1·35	11·2
11	1·25	7·4	1·25	7·4	1·0	1·4	1·4	13·2	1·35	11·2
12	1·25	7·4	1·25	7·4	0·95	1·0	1·45	15·6	1·3	9·2
13	1·3	9·2	1·25	7·4	0·95	1·0	1·4	13·2	1·3	9·2
14	1·25	7·4	1·25	7·4	1·0	1·4	1·4	13·2	1·3	9·2
15	1·25	7·4	1·25	5·7	1·0	1·4	1·4	13·2	1·3	9·2
16	1·25	7·4	1·25	7·4	1·0	1·4	1·4	13·2	1·1	3·1
17	1·2	5·7	1·25	7·4	1·0	1·4		12·2	1·0	1·4
18	1·2	5·7	1·2	5·7	1·0	1·4	1·35	11·2	0·9	0·5
19	1·2	5·7	1·25	7·4	1·0	1·4	1·35	11·2	0·9	0·5
20	1·2	5·7	1·2	5·7		1·4	1·35	11·2		
21	1·2	5·7	1·2	5·7	1·0	1·4	1·35	11·2		
22	1·2	5·7	1·25	7·4	1·0	1·4	1·3	9·2		
23	1·15	4·4	1·2	5·7	1·0	1·4	1·3	9·2		
24	1·2	5·7		5·1		1·2		9·2		
25	1·2	5·7	1·15	4·4	0·95	1·0	1·3	9·2		
26	1·2	5·7	1·3	9·2		2·0	1·3	9·2		
27		5·7	1·25	7·4	1·1	3·1	1·3	9·2		
28	1·2	5·7	1·25	7·4	1·1	3·1	1·3	9·2		
29	1·2	5·7		6·8	1·05	2·2		11·2		
30	1·2	5·7		6·2	1·05	2·2		13·4		
31	1·25	7·4			1·0	1·4		15·8		

DAILY GAUGE HEIGHTS AND DISCHARGES of Hefferly Creek at Crawshaw's Ditch for 1913.

DAY.	May.		June.		July.		August.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	0·4	2·6	0·25	1·4	.....	2·8
2	.....	.....	0·4	2·6	0·3	1·8	0·45	3·0
3	.....	.....	0·4	2·6	0·3	1·8	.....	2·8
4	.....	.....	0·35	2·2	0·3	1·8	0·4	2·6
5	.....	.....	0·4	2·6	0·25	1·4	0·35	2·2
6	.....	.....	.....	2·8	0·25	1·4	0·35	2·2
7	.....	.....	0,45	3·0	0·2	1·0	0·5	3·5
8	.....	.....	0·45	3·0	0·15	0·7	0·5	3·5
9	.....	.....	0·45	3·0	0·2	1·0	0·0	0·0
10	.....	.....	0·45	3·0	0·15	0·7	.....	0·0
11	.....	.....	0·45	3·0	0·0	0	.....	.....
12	.....	.....	0·5	3·5	0·0	0	.....	.....
13	0·35	2·2	0·5	3·5	0·15	0·7	.....	.....
14	0·35	2·2	0·5	3·5	0·15	0·7	.....	.....
15	0·35	2·2	0·5	3·5	0·1	0·4	.....	.....
16	0·3	1·8	0·5	3·5	0·0	0·0	.....	.....
17	0·25	1·4	0·5	3·5	.....	0·0	.....	.....
18	0·3	1·8	0·5	3·5	.....	0·0	.....	.....
19	0·3	1·8	0·5	3·5	.....	0·0	.....	.....
20	0·3	1·8	0·5	3·5	.....	0·0	.....	.....
21	0·3	1·8	0·5	3·5	.....	0·0	.....	.....
22	0·3	1·8	0·5	3·5	.....	0·0	.....	.....
23	0·4	2·6	0·5	3·5	.....	0·0	.....	.....
24	0·4	2·6	0·5	3·5	.....	0·0	.....	.....
25	0·4	2·6	0·5	3·5	.....	0·0	.....	.....
26	0·4	2·6	0·3	1·8	.....	0·0	.....	.....
27	0·4	2·6	0·3	1·8	.....	0·0	.....	.....
28	0·4	2·6	0·25	1·4	0·5	3·5	.....	.....
29	0·4	2·6	.....	1·4	0·45	3·0	.....	.....
30	0·4	2·6	.....	1·4	0·45	3·0	.....	.....
31	0·3	1·8	.....	.....	0·4	2·6	.....	.....

INGRAM CREEK NEAR ADELPHI.

Location.—Section 23, township 17, range 13, 3 miles east of Adelphi (Grand Prairie).

Records Available.—April 1, 1911, to October 4, 1911; April 1, 1912, to August 31, 1912; April 1, 1913, to September 16, 1913.

Winter Conditions.—There are generally some severe cold spells, and snowfall is usually light.

Gauge.—The gauge is a vertical staff gauge and daily readings are taken during the irrigation season by Miss Mildred King.

Discharge Measurements.—The stream is well rated by measurements covering the stream's range (made during 1911-12-13.)

Accuracy.—The gauge readings were accurately made and the general accuracy is high.

INGRAM CREEK.

Ingram creek rises in the Bouleau hills just south of Grand Prairie, at an elevation of about 4,000 feet, and flows into Salmon river, in township 17, range 13, west of the 6th meridian, 3 miles east of Grand Prairie village, at an elevation of about 1,800 feet. The creek is about 9 miles long, and drains an area of 25 square miles. The drainage area is a broken plateau extending southerly from the bowl-shaped Grand Prairie to the Bouleau hills, which separate Ingram creek and

Salmon river from Okanagan divide. About 7 miles from the mouth of Ingram creek there is a meadow, called Homfray's meadow, which could be used as a reservoir in which to store the surplus waters of the May floods. At Homfray's meadow the creek has an abrupt turn from the east, and about a mile from this turn the creek divides into two forks. On the north fork there are two meadows which might be suitable for storage reservoirs. These are Wolf's and Jo' nston's meadows. On account of improvements on Wolf's meadow or homestead, Johnston's meadow might be the only site available for storage, unless the economic value of the stored water in Homfray's and Wolf's meadow for use in the valuable Grand Prairie lands be considered greater than the said meadows for actual cultivation.

The mean annual precipitation in Grand Prairie and the Ingram Creek drainage is about 12 inches. Irrigation is necessary and the waters of Ingram creek are extremely valuable for irrigation purposes. Some of the water is now used on the Ingram estate and neighbouring lands at the mouth of the stream, but by far the greater proportion of the flood water of May and June run to waste into Salmon river.

There are some six old provincial water records from Ingram creek, the first one dated (1871) being appurtenant to the Ingram estate, and practically controlling the natural flow of the stream during the latter part of the irrigation season.

The run-off of Ingram creek has been studied during the open season of 1911, 1912 and 1913. A station was established a short distance above the mouth and all irrigation diversions. Meter measurements were taken and daily records of gauge heights. The resulting hydrographic data for the periods, April 1 to September 30, 1911, and April 1 to September 1, 1912, are appended. The year 1911 was a dry year throughout nearly the whole dry belt. The maximum discharge of Ingram creek took place on May 17, 1911, and was 52 cubic feet per second (gauge height 1·64 feet.) The minimum flow occurred September 19, and was 0·5 c.f.s., with a gauge height of 0·3 feet. The totalr un-off from April 1 to September 30, was a little over 3,000 acre-feet. The flow prior to April 1, and later than September 30, was very small, being less than 1 c.f.s.

The year 1912, had a much larger run-off. The maximum discharge took place again on May 17, and was 130 c.f.s., with a gauge height of 2.15 feet. The minimum recorded stage was on August 9, being 3·0 c.f.s. at the gauge height of 0·65 feet. The total run-off from April 1 to September 1, 1912, was 7,000 acre-feet.

The maximum recorded stage for 1913, of 165 c.f.s. occurred on May 16, and the minimum of 5·0 on September 6.

Discharge Measurements of Ingram Creek near Grand Prairie, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec. ft.
May 24	C. E. Richardson	1,048	18	20·3	1·88	1·51	38·2
May 24	C. G. Cline	1,046	18	19·6	1·86	1·51	36·5
June 6	W. M. Carlyle	1,044	15	8·2	0·95	1·015	7·9
July 12	do	1,044	14	9·1	0·64	0·90	5·9
July 26	do	1,044	7	2·9	0·93	0·62	2·7
Aug. 23	do	1,044	5	2·0	0·74	0·46	1·5
1912.							
May 12	C. E Richardson	1,048	18	18·5	3·08	1·68	57·0
July 16	do	1,048	5	4·7	1·28	0·82	6·0
April 23	H. J. E. Keys	1,057	18	7·3	2·10	1·18	15·1
June 28	do	1,057	14	8·5	1·50	1·12	12·9

Monthly Discharge of Ingram Creek near Grand Prairie for 1913.

(Drainage area, 25 square miles.)

Month.	Discharge in Second-Feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April	47·0	8·0	19·9	0·80	0·89	1,180
May	165·0	18·0	93·5	3·70	4·27	5,790
June	81·5	20·5	41·4	1·66	1·85	2,460
July	81·5	9·5	28·7	1·15	1·33	1,760
August	9·5	5·0	6·6	0·26	0·30	406

Daily Gauge Heights and Discharges of Ingram Creek near Grand Prairie for 1913.

Day.	April.		May.		June.		July.		August.		September.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	8·0	1·4	27·5	1·8	74·0	1·6	47·0	1·05	9·5	0·9	6·0
2	.....	8·0	1·35	24·0	1·7	60·0	1·5	36·5	1·0	8·0	0·9	6·0
3	.....	8·0	1·3	20·5	1·6	47·0	1·5	36·5	1·0	8·0	0·9	6·0
4	.....	8·0	1·35	24·0	1·5	36·5	1·5	36·5	1·0	8·0	1·0	8·0
5	.....	8·0	1·35	24·0	1·55	41·5	1·55	41·5	0 9	6 0	0 9	6·0
6	.....	11·0	1·35	24·0	1·5	36·5	1·55	41·5	0·9	6·0	0·9	6·0
7	.....	11·0	1·3	20·5	1·5	36·5	1·5	36·5	0·95	7·0	0·9	6·0
8	.....	11·0	1·25	18·0	1·5	36·5	1·45	32·0	1·0	8·0	0·85	5·5
9	.....	11·0	1·4	27·5	1·5	36·5	1·4	27·5	1·0	8·0	0·85	5·5
10	.....	11·0	1·8	74·0	1·4	27·5	1·4	27·5	0·9	6·0	0·9	6·0
11	.....	15·5	2·0	104·0	1·3	20·5	1·3	20·5	0·9	6·0	0·9	6·0
12	.....	15·5	2·0	104·0	1·8	74·0	1·4	27·5	0·9	6·0	0·9	6·0
13	.....	15·5	2·2	135·0	1·85	81·5	1·6	47·0	0·9	6·0	0·85	5·5
14	.....	15·5	2·25	142·0	1·6	47·0	1·7	60·0	0·9	6·0	0·85	5·5
15	.....	15·5	2·4	165·0	1·6	47·0	1·85	81·5	0·9	6·0	0·8	5·0
16	1·3	20·5	2·4	165·0	1·4	27·5	1·55	41·5	0·9	6·0	0·8	5·0
17	1·3	20·5	2·3	150·0	1·3	20·5	1·4	27·5	0·95	7·0	.....	.....
18	1·5	36·5	2·25	142·0	1·4	27·5	1·3	20·5	1·0	8·0	.....	.....
19	1·6	47·0	2·2	135·0	1·4	27·5	1·3	20·5	1·0	8·0	.....	.....
20	1·5	36·5	2·2	135·0	1·4	27·5	1·2	15·5	1·0	8·0	.....	.....
21	1·6	47·0	1·95	96·5	1·4	27·5	1·3	20·5	0·8	5·0	.....	.....
22	1·5	36·5	1·95	96·5	1·3	20·5	1·3	20·5	0·8	5·0	.....	.....
23	1·4	27·5	2·0	104·0	1·3	20·5	1·3	20·5	0·9	6·0	.....	.....
24	1·4	27·5	2·1	120·0	1·65	53·5	1·2	15·5	0·9	6·0	.....	.....
25	1·3	20·5	2·1	120·0	1·7	60·0	1·15	13·0	0·9	6·0	.....	.....
26	1·3	20·5	2·2	135·0	1·7	60·0	1·1	11·0	0·9	6·0	.....	.....
27	1·25	18·0	2·3	150·0	1·6	47·0	1·1	11·0	0·85	5·5	.....	.....
28	1·3	20·5	2·2	135·0	1·5	36·5	1·2	15·5	0·9	6·0	.....	.....
29	1·3	20·5	2·0	104·0	1·5	36·5	1·2	15·5	0·9	6·0	.....	.....
30	1·35	24·0	1·9	89·0	1·6	47·0	1·1	11·0	0·9	6·0	.....	.....
31	.....	.....	1·9	89·0	.....	.....	1·05	9·5	0·95	7·0	.....	.....

JACKO CREEK.

Location.—Section 5, township 19, range 18, west 6th meridian.

Records Available.—May 1 to September 30, 1912; May 7 to August 31, 1913.

Winter Conditions.—Stream is usually dry by the middle of September, and commences to flow in April. Light snowfall.

Gauge.—Vertical staff gauge read tri-weekly by Muir Watson.

Channel.—The bed of the stream is gravelly, and the channel is about 5 feet in width. A maximum flow of 15 second-feet was recorded on May 16, 1912.

Discharge Measurements.—Five discharge measurements give a fairly well-defined curve.

Accuracy.—The accuracy of returns is fair and results are thought to be within 10 per cent of true conditions.

JACKO CREEK.

Jacko creek has its source in the hills 20 miles south of Kamloops, at an elevation of 3,800 feet, and discharges into Jacko lake near Kamloops at an elevation of 2,200 feet. It is part of the Peterson-Thompson drainage. The drainage area, as measured from the Geological Survey map, dated 1895, scale 2 miles to 1 inch, is 13 square miles. Three small unnamed creeks enter from the right, going upstream. Jacko creek is a small but very contentious irrigation stream in the most arid section of the dry belt. The summers are hot and dry, the winters long and cold (-30° F.).

Jacko creek, rising in a swamp, descends rapidly for about 6 miles through a densely wooded country, where it flows sluggishly through irrigable land to Jacko lake. The water in Jacko creek is subject to the records on Jacko lake and Peterson creek, of which it is the chief tributary. (See Peterson creek for further information.) In 1911 and for the preceding four years, no water reached Jacko lake; this fact formed the basis of bitter fights in the courts. From observations made in 1912, it appears that there is an enormous loss of water due to seepage. With a discharge of 7 second-feet at the gauging station, there was no more than 2 second-feet lower down, all the irrigation ditches being closed.

The river station on Jacko creek was established above all diversions on May 1, 1912, by H. J. E. Keys. The measuring section is located about 100 feet above the Watson diversion, and 100 yards west of the Kamloops-Trout lake road. A standard vertical staff gauge is located on the right bank at the measuring section. All measurements were made by wading. This is an excellent measuring section; with good control; high banks, uniform current and one permanent channel.

The datum of the gauge is referred to one bench mark.

DISCHARGE MEASUREMENTS of Jacko Creek, near Kamloops 1911-12-13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
June 8	W. M. Carlyle	1,044	2·7	1·4	0·35	1·0	0·5
1912.							
May 18	H. J. E. Keys	1,057	7·0	6·1	1·17	2·0	[1]7·2
" 29	do	1,057	5·0	5·0	0·64	1·8	3·2
July 11	do	1,057	3·0	1·2	0·50	1·42	0·5
1913.							
May 29	do	1,057	4·5	4·2	0·7	1·81	3·0
Aug. 31	do	1,057				0·0	0·0

NOTE.—[1] New gauge.

Monthly Discharge of Jacko Creek, near Kamloops for 1913.

(Drainage area, 13 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	7·0	2·0	3·3	0·25	0·29	203
June	3·0	0·8	1·99	0·15	0·17	118
July	3·0	0·2	0·99	0·08	0·09	61
August	0·2	0·0	0·1	0·01	0·02	6

Daily Gauge Heights and Discharges of Jacko Creek above all diversions for 1913.

Day.	May.		June.		July.		August.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	.....	3·0	1·8	3·0	.....	0·2
2	.....	.....	1·8	3·0	.....	2·5	.....	0·2
3	.....	.....	.....	2·5	1·7	2·0	.....	0·1
4	.....	.....	1·7	2·0	.....	1·6	0·9	0·1
5	.....	.....	.....	2·0	1·6	1·3	.....	0·1
6	.....	.....	.....	2·0	.....	1·3	0·6	0·1
7	1·7	2·0	1·7	2·0	1·6	1·3	.....	0·1
8	.....	2·5	.....	2·0	.....	1·1	0·6	0·1
9	1·8	3·0	1·7	2·0	1·5	0·8	.....	0·1
10	1·9	4·5	.....	2·0	.....	0·8	.....	0·1
11	.....	5·7	1·7	2·0	.....	0·8	0·6	0·1
12	2·0	7·0	.....	1·8	1·5	0·8	.....	0·1
13	.....	7·0	.....	1·5	.....	1·1	1·0	0·1
14	2·0	7·0	1·6	1·3	1·6	1·3	.....	0·1
15	.....	5·7	.....	1·3	.....	1·3	.....	0·1
16	1·9	4·5	1·6	1·3	1·6	1·3	1·0	0·1
17	.....	4·5	.....	1·0	.....	1·1	.....	0·2
18	.....	4·5	1·5	0·8	.....	0·9	1·3	0·2
19	1·9	4·5	.....	1·0	1·5	0·8	.....	0·2
20	.....	3·8	.....	1·2	.....	0·8	1·2	0·2
21	1·8	3·0	1·6	1·3	1·5	0·8	.....	0·2
22	.....	3·0	.....	1·3	.....	0·6	1·0	0·1
23	.....	3·0	1·6	1·3	1·4	0·4	.....	0·1
24	1·8	3·0	.....	2·1	.....	0·4	.....	0·1
25	.....	3·8	1·8	3·0	.....	0·4	0·8	0·1
26	1·9	4·5	.....	3·0	1·4	0·8	.....	0·1
27	.....	3·8	.....	3·0	.....	0·4	dry	0·0
28	1·8	3·0	1·8	3·0	1·4	0·4	.....	.....
29	.....	3·0	.....	3·0	.....	0·3	.....	.....
30	1·8	3·0	1·8	3·0	1·3	0·2	.....	.....
31	.....	3·0	.....	.....	1·3	0·2	.....	.....

JAMIESON CREEK.

Location.—Section 21, township 22, range 17, west 6th meridian.

Records Available.—June 20 to October 30, 1911; April 3 to October 30, 1912; May 6 to October 1, 1913; and numerous float measurements by the courtesy of Arthur E. Meighan, C. E., General Manager British Columbia Fruitlands Company, made during 1907, 1908, and 1909.

Winter Conditions.—Jamieson creek is usually frozen up during December, January, and February, and the run-off in November and March is very small.

Gauge.—Vertical staff gauge installed above the diversion of the British Columbia Fruitlands Company. It is read daily by E. Sutton during the open period.

Channel.—Channel is about 30 feet in width, with muddy and rocky bottom. Discharge varies from zero to a maximum of 500 cubic feet at normal high water. Mr. Meighan records a flow of 1,400 second-feet following a cloudburst on May 19, 1907.

Discharge Measurements.—The returns submitted are compiled from a well-defined curve, meterings having been made at all stages of flow.

Accuracy.—The accuracy on the whole is high and results are considered to be well within 10 per cent of actual conditions.

JAMIESON CREEK.

Jamieson creek has its source in the hills north of the Tranquille Forest reserve, outside the Railway Belt, at an elevation of 5,000 feet. It discharges into the North Thompson river from the west, 18 miles north of Kamloops, at an elevation of 1,170 feet. It is part of the North Thompson drainage. The area of the watershed is 66 square miles. The creek is in the dry belt, and the water is used for irrigation. The mean annual precipitation is from 10 to 12 inches. Owing to the influence of the valley of the North Thompson river, the climate is a little cooler than at Kamloops and the snow remains on the ground much longer in the winter.

The water of Jamieson creek is used by the British Columbia Fruitlands Company for the irrigation of their lands along the North Thompson and the main Thompson rivers. The intake is situated about a mile from the mouth of the creek. Water has been used from Jamieson creek for this purpose for a number of years, but a new canal and flume line has recently been constructed by the company to replace the old system. The canal is lined with concrete to prevent seepage. When necessary, galvanized steel fluming has been used and one inverted syphon of 48 inches diameter has been constructed of wood stave pipe. The main system is about 15 miles long, and will serve some 6,000 acres of the company's land.

The British Columbia Fruitlands Company, have constructed a storage dam on Wentworth lake, near the head of the creek, but small storage has been secured.

The main station on Jamieson creek is 100 feet above the British Columbia Fruitlands dam, and measures the total flow of the stream. It was established June 20, 1911, and gauge readings were taken till October 31, 1911, from April 3 to October 31, 1912, and from May 6 to October 1, 1913. The gauge is a 5 foot cedar staff nailed to tree stump on the left bank of the stream, 100 feet above the British Columbia Fruitlands Company's dam. Its datum is referred to three permanent bench-marks. The meter measurements were made by wading at a section 25 feet below the gauge. The channel is straight for 25 feet above the section, and the water swift. There is a straight channel for 75 feet below the section, with riffles and then the dam crest. The right bank is a rock cliff 100 feet high. The left bank is 3 feet high and covered with bushes, but is not likely to overflow. There is a gravel bar in the bed itself which at a certain stage divided the creek into two branches near the gauge. This occurs at a gauge height of 3·0 for a range of about 0·6 feet. Above that stage the water flows over the bar, and the stream becomes one; below the stage the second stream stops running. The gauge is only about 100 feet above the dam, and although there is considerable fall in that distance the engineer

should note particularly each trip that no change has been made at the dam to affect the height of the water at the gauge, and that there are still riffles between the gauge and the dam.

A second station was established below the dam to show the amount of unused water and to give some idea of the water diverted by the British Columbia Fruitlands ditch. It was found, however, that there was considerable loss by seepage from the stream into the gravel beds between the two stations. Hence the amount of unused water is larger than the figures given by lower station; the amount of water diverted cannot be found by comparing the surface flow at the two stations. Gauge readings were taken at the lower station, from June 22, 1911, when the station was established, to October 30, 1911; and from April 3 to July 12, 1912. The gauge readings at this station will not be continued another season.

DISCHARGE MEASUREMENTS of Jamieson's creek near Upper station, 1911-1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
June 20	C. G. Cline	1,046	24	27·6	2·21	2·35	61·10
Aug. 20	do	1,046	19	13·2	0·64	1·78	8·43
Oct. 7	C. K. Smith	1,046	20	15·0	0·51	1·82	7·66
1912.							
June 21	H. J. E. Keys	1,046	.....	14·5	1·77	2·30	[1]57·50
July 8	do	1,057	23	31·1	1·79	2·33	55·70
1913.							
June 11	do	1,057	26	26·2	3·50	2·65	[2]103·00
July 16	do	1,057	31	57·1	2·80	2·88	167·00

NOTE.—[1] Sum of diversions and discharge at Lower station.
[2] Different section.

MONTHLY DISCHARGE of Jamieson Creek near Black Pine P. O. for 1913.

(Drainage area, 66 square miles.)

Month.	Discharge in Second-Feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	530	140	295	4·47	5·15	18,100
June	295	69	148	2·25	2·51	8,810
July	123	40	85	1·29	1·49	5,230
August	103	45	74	1·12	1·29	4,550
September	77	12	40	0·61	0·68	2,380

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DAILY GAUGE HEIGHTS AND DISCHARGES of Jamieson Creek, near Black Pine, P. O., for 1913.

Date.	May.		June.		July.		August.		September.		October.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
1	.....	140	.....	265	.....	123	.....	82	2·2	49	1·95	15
2	.....	150	3·2	240	2·6	103	.....	83	.....	47	.....	.....
3	.....	160	.....	215	.....	71	.....	84	2·3	54	.....	.....
4	.....	170	3·0	190	2·2	40	2·5	85	.....	61	.....	.....
5	.....	180	.....	130	.....	61	.....	77	2·4	69	.....	.....
6	3·0	190	2·4	69	.....	82	2·4	69	.....	59	.....	.....
7	.....	200	.....	94	2·6	103	.....	69	.....	50	.....	.....
8	3·1	215	.....	120	.....	86	2·4	69	2·2	40	.....	.....
9	.....	325	2·8	143	2·4	69	.....	64	.....	34	.....	.....
10	3·9	440	.....	132	.....	77	.....	59	2·1	28	.....	.....
11	.....	440	2·7	122	2·5	85	2·3	54	.....	34	.....	.....
12	3·9	440	.....	105	.....	87	.....	69	2·0	40	.....	.....
13	.....	380	2·5	85	.....	89	2·5	85	.....	50	.....	.....
14	3·5	325	....	91	.....	91	.....	85	.....	60	.....	.....
15	.....	310	.....	97	.....	93	2·5	85	2·45	77	.....	.....
16	3·4	295	2·6	103	.....	95	.....	91	.....	65	.....	.....
17	.....	295	.....	94	.....	97	.....	97	2·3	54	.....	.....
18	3·4	295	2·5	85	.....	99	2·6	103	.....	47	.....	.....
19	.....	320	.....	105	.....	100	.....	103	2·2	40	.....	.....
20	3·6	350	2·7	122	.....	101	2·6	103	.....	36	.....	.....
21	.....	370	.....	129	2·6	103	.....	93	.....	32	.....	.....
22	.....	390	.....	136	.....	94	.....	83	2·1	28	.....	.....
23	3·8	410	2·8	143	2·5	85	.....	73	.....	25	.....	.....
24	.....	450	.....	154	.....	77	.....	63	2·05	23	.....	.....
25	.....	490	2·9	166	2·4	69	2·3	54	.....	21	.....	.....
26	4·2	530	.....	230	.....	70	.....	54	2·0	19	.....	.....
27	.....	470	3·4	295	.....	72	2·3	54	.....	17	.....	.....
28	3·8	410	.....	245	.....	74	.....	54	.....	15	.....	.....
29	.....	370	.....	195	.....	76	2·3	54	1·9	12	.....	.....
30	3·5	325	2·8	143	.....	78	.....	49	.....	13	.....	.....
31	.....	295	.....	.....	.....	80	.....	45	.....	.....	.....	.....

LOUIS CREEK AT NORTH BOUNDARY OF RAILWAY BELT.

Location.—Section 33, township 23, range 15, west 6th meridian at Leslie's ranch.

Records Available.—July 16, to October 31, 1911; April 1 to November 16, 1912; May 1 to October 14, 1913.

Winter Conditions.—Not very severe, but with occasionally heavy snowfall. Open conditions often exist throughout the year.

Gauge.—Standard vertical staff gauge read daily during 1911 and 1912 and tri-weekly during 1913.

Channel.—The width of the stream varies from 25 to 35 feet, the control is good and the station on the whole excellent.

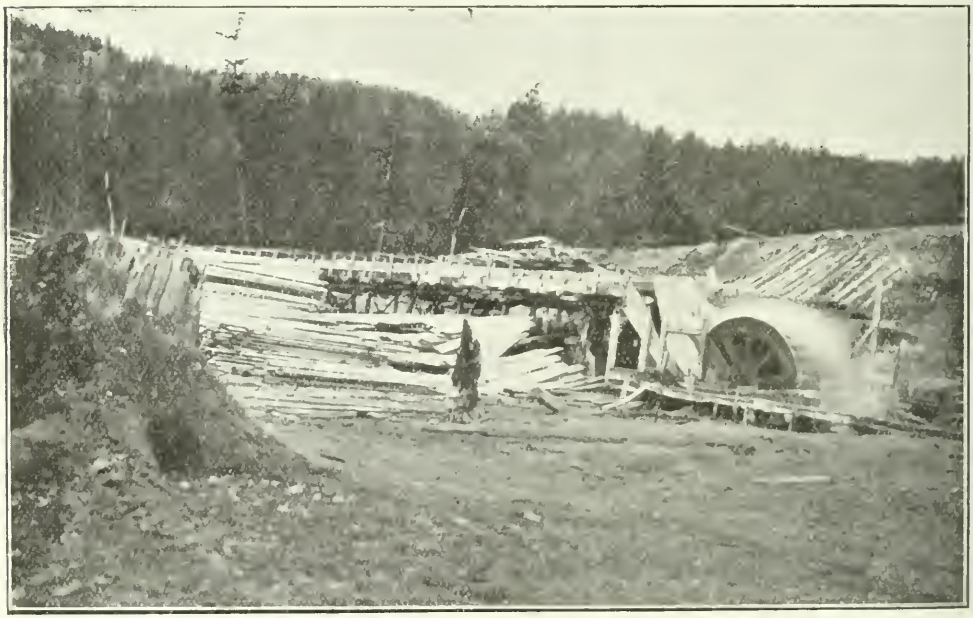
Accuracy.—Gauge readings were carefully made and the accuracy of returns is fairly high (within 10 per cent.)

LOUIS CREEK.

Louis creek has its source in the Niskonlith creek divide township 21, range 14, west 6th Meridian, at an elevation of 3,100 feet, and discharges into the North Thompson, 36 miles north of Kamloops from the east, at an elevation of 1,160 feet. It is part of the Thompson drainage; the drainage area, as measured from the Geological Survey map, dated 1895, scale 2 miles to 1 inch, is 180 square

miles. Of this area, 100 square miles is above the river station. Louis creek has a small industrial water-power, and is used a little for irrigation purposes near the mouth in the North Thompson valley. The ranchers in the Louis Creek valley don't require any irrigation except in very dry years, as the stream is almost entirely outside the dry belt. It is probable that the mean annual precipitation is from 15 to 25 inches. The valley is bounded by high precipitous mountains; heavily timbered, whose snow feeds the creek as well as its tributaries Fadear, Cahilty, and McGillivary creeks, entering from the east and Christian creek from the west near the headwaters. There is a small sawmill at the mouth operated by power from the creek, and similar industrial powers would be possible on the lower 5 miles of the stream, where the stream falls rapidly, in contrast to its sluggishness in its upper 20 miles. The tributaries of Louis creek also have good power possibilities and should a market arise, would warrant a thorough investigation.

The river station on Louis creek was established on Ausust 16, 1911, by C. G. Cline. It is located at a bridge on the Leslie ranch, 2 miles south of the Railway Belt boundary, and about 12 miles from the mouth. The purpose of this location was to determine the amount of Louis creek water rising in the Railway Belt. A standard vertical staff gauge, 7 feet long, is located on the right bank 50 feet above the aforementioned bridge, and its datum referred to three benchmarks. The measuring section is at the bridge; in low water the measurements are made by wading, in high water by means of a cable from the bridge. This is a good section, the control is fair, the current uniform, the banks high, and one permanent channel.



Louis Creek—Undersnot Wheel and Sawmill.

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Discharge Measurements of Louis Creek, at Leslie's Ranch, 1911-12, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq.-ft.	Ft. per sec.	Feet.	Sec.-ft.
Aug. 16-12....	C. G. Cline	1,046	25	33·4	0·80	0·91	28
Sept. 11-11....	do	1,046	26	36·8	0·96	0·98	35·4
Apr. 30-12....	Cline & Dann	1,046	26	49·4	1·7	1·50	94
May 16-12....	E. M. Dann	1,044	31	108·2	4·0	3·80	439
May 29-12....	do	1,044	28	90	3·6	3·20	328
June 8-12....	do	1,044	28	82	3·4	2·72	276
June 9-12....	do	1,044	28	85	3·4	2·81	288
Aug. 22-12....	H. J. E. Keys	1,057	30	19	2·8	1·02	52[1]
June 28-13....	do	1,057	33	58	2·65	2·10	155

Note.—[1]Different M. Section.

Monthly Discharge of Louis Creek at Leslie's Ranch, for 1913.

(Drainage area, 100 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	398	50	172	1·72	1·98	10,600
June	454	144	250	2·50	2·79	14,900
July	165	57	98	0·98	1·13	6,025
August	65	42	54	0·54	0·62	3,320
September	48	38	42	0·42	0·47	2,500

Daily Gauge Heights and Discharges of Louis Creek at Leslie's Ranch, for 1913.

Day.	April.		May		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	.....	50	3·6	406
2	.....	.....	1·0	50	3·9	454
3	.....	.....	.....	50	.....	450
4	.....	.....	.....	50	.....	446
5	.....	.....	1·0	50	3·2	342
6	.....	.....	.....	60	3·0	310
7	.....	.....	.....	70	.....	323
8	.....	.....	.....	80	.....	336
9	.....	.....	1·45	89	3·25	350
10	.....	.....	2·0	158	.....	308
11	.....	.....	.....	162	.....	279
12	.....	.....	2·05	165	2·6	246
13	.....	.....	.....	158	2·4	215
14	.....	.....	.....	151	2·35	208
15	.....	.....	.....	144	2·15	179
16	.....	.....	1·85	137	2·2	186
17	.....	.....	.....	139	2·25	193
18	.....	.....	.....	141	1·9	144
19	.....	.....	1·9	144	2·2	186
20	.....	.....	.....	158	2·15	179
21	.....	.....	.....	172	2·1	172
22	.....	.....	.....	186	2·3	200
23	.....	.....	2·3	200	2·2	186
24	.....	.....	.....	230	2·1	172
25	.....	.....	.....	260	2·15	179
26	.....	.....	.....	290	2·15	179
27	.....	.....	.....	325	2·1	172
28	1·05	54	3·3	358	2·1	172
29	.....	.....	.....	354	2·05	165
30	.....	.....	3·25	350	1·95	151
31	.....	.....	3·55	398	.....	.....

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DAILY GAUGE HEIGHTS AND DISCHARGES of Louis Creek at Leslie's Ranch for 1913—*Concluded.*

Day.	July.		August.		September.		October.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·95	151	1·1	57	0·8	40	.....	.....
2	1·85	137	1·05	54	.....	42	.....	.....
3	1·85	137	.....	58	.....	44	0·8	40
4	1·7	117	1·15	61	.....	46	.....	.....
5	1·6	105	.....	60	0·95	48	.....	.....
6	1·5	94	.....	58	.....	47	0·75	38
7	1·55	100	.....	56	.....	46	.....	.....
8	1·5	94	1·05	54	0·9	45	.....	.....
9	1·4	84	.....	52	.....	44	.....	.....
10	1·4	84	.....	50	.....	43	0·8	40
11	1·5	94	0·95	48	.....	42	.....	.....
12	1·5	94	.....	48	0·8	40	.....	.....
13	1·5	94	.....	49	.....	41	1·15	61
14	1·95	151	.....	49	.....	42	.....	.....
15	2·05	165	1·0	50	0·85	43	.....	.....
16	2·0	158	.....	55	.....	43	.....	.....
17	.....	141	.....	60	.....	43	.....	.....
18	.....	124	1·2	65	.....	43	.....	.....
19	.....	107	.....	64	0·85	43	.....	.....
20	1·45	89	.....	63	.....	43	.....	.....
21	1·4	84	.....	62	.....	43	.....	.....
22	1·4	84	1·15	61	0·85	43	.....	.....
23	1·3	74	.....	57	.....	42	.....	.....
24	1·15	61	.....	53	.....	41	.....	.....
25	.....	61	0·95	48	.....	40	.....	.....
26	.....	61	.....	48	0·75	38	.....	.....
27	.....	61	.....	48	.....	38	.....	.....
28	1·15	61	.....	48	.....	38	.....	.....
29	1·1	57	0·95	48	0·75	38	.....	.....
30	.....	57	.....	45	.....	38	.....	.....
31	.....	57	.....	42	.....	.....	.....	.....

MONTE CREEK (ABOVE BOSTOCK'S DIVERSION.)

Location.—Section 25, township 19, range 15, west 6th meridian.

Records Available.—May 20 to June 30, 1911; August 8, 1911; April 8, 1911; to September 7, 1912; April 16 to September 13, 1913.

Winter Conditions.—Monte creek is frozen up as a general rule during December, January, and February, while the flow is very small during October and November. Snowfall is light though there are sometimes short periods of severe cold during the winter.

Gauge.—Standard vertical staff gauge read semi-weekly by T. F. Teagle during the irrigation season.

Channel.—The channel is about 15 feet in width and the bed rocky. The flow varies from zero to 100 cubic feet per second during high freshet; 117 cubic feet per second is the highest flow recorded, which occurred on May 18, 1912.

Discharge Measurements.—The gauge-height discharge curve is well defined.

Accuracy.—Accuracy of results submitted is high.

MONTE CREEK.

Monte creek is a stream about 20 miles long rising in Monte hills, 5 miles west of Grand Prairie, at an elevation of 4,000 feet and, flowing northerly, discharges into the South Thompson river at Ducks, B.C. It is a stream about 6 feet wide and from 1 foot to 2 feet deep, with a mean velocity of from 4 to 5 feet per second. This stream flows through an agricultural district in the dry

belt and is a very contentious irrigation stream. Senator Bostock, a large land owner in this vicinity, irrigates hundreds of acres of land in the Monte Creek Valley, and also bench and bottom lands in the Thompson river valley near the mouth of the creek. Records on this creek are held to divert water from Monte creek at a point about 15 miles from the mouth, Summit lake, where it is stored and used when required on lands near Grand Prairie in the Salmon river drainage area. In 1912 there was plenty of water for all concerned, but in previous years considerable trouble arose, due to the scarcity of water. There is a small storage reservoir near the source of Monte creek, with a capacity of 2,000 acre-feet.

The precipitation is about 12 inches throughout the valley, of which about 4 inches is snow. The winters are short and cold and the summers hot and dry. The creek freezes up during the months of December, January, and February.

Regular gauging stations were established on Monte Creek: (1) Above Bostock's diversion, (2) below diversions to Summit lake, (3) diversions to Summit lake.

The station on Monte creek above Bostock's diversion was established on May 20, 1911, by C. E. Richardson. The measuring section is located 300 yards above the Bostock headgate, 1½miles from Ducks, and 100 yards from the wagon road from Ducks to Grand Prairie.

The gauge is a standard vertical staff near the measuring section on the right bank of the stream. Measurements were made by wading with Price electric current meter. The channel above and below the station is straight for 50 ft., the water is fairly fast. The right bank is steep for 15 feet to the wagon road. The left bank is low and heavily timbered, but there is no change of overflow. The bed of the stream is silt at the measuring section and gravel at the gauge. There is only one channel and its depth is from 1′ to 3′. Three bench marks were established and referred to the gauge datum.

The station on Monte Creek below the diversion to Summit lake was established on May 25, 1911, by C. E. Richardson. The measuring section is 100 yards below the diversion near T. Graham's and ½ mile west of the Grand Prairie-Monte creek wagon road, 6 miles from Grand Prairie. The gauge is a vertical staff 4″ x 1½″ x 4′. (cedar) marked in feet and tenths from 3′ to 7.′7 fastened to the right bank of the stream 100 yds. below the diversion. Measurements are made with Price electric current meter and wading equipment. The channel above and below the station is straight for 100 feet and the water flows with a uniform velocity. The banks are steep and high and sparsely timbered. The bed of the stream is gravelly; there is only one channel with a depth of from 6″ to 2. 5″ . Three bench marks were established and referred to the gauge datum.

Discharge Measurements of Monte Creek above Bostock's diversion, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.		Feet.	Sq.-ft.	Ft. per sec.	Feet.	Sec.-ft.	
Apr. 22.....	H. J. E. Keys.....	1057	13·0	12·9	1·3	1·35	17·5
June 17.....	do	1057	14·0	8·1	1·4	1·23	11·4[1]

Note.—[1]Different measuring section.
Gauge Reader—T. F. Teagle.

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Monthly Discharge of Monte Creek above Bostock's diversion for 1913.

(Drainage area, 110 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	44	11	30	·27	·31	1,845
June	41	11	18·1	·16	·18	1,077
July	7·9	2·3	4·2	·04	·05	258
August	2·7	1·6	2·3	·02	·02	141

Note.—The flow through the diversion into Summit lake has not been included in above.—

Daily Gauge Heights and Discharges of Monte Creek, above Bostock's diversion for 1913.

Day.	April.		May.		June.		July.		August.		September.	
	Gauge Height.	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1				20		23	1·1	7·2		2·5		1·6
2			1·3	15·3		20		7·4	0·82	2·7		1·6
3				14		18		7·6		2·6	0·67	1·6
4				13	1·3	15·3		7·8		2·5		1·6
5				12		14	1·12	7·9		2·4		1·7
6				11		13		7·0	0·79	2·4	0·7	1·7
7			1·2	10·5	1·25	12·7		6·1		2·4		1·7
8				17		12		5·2		2·5		1·6
9				24		11		4·3	0·8	2·5		1·5
10			1·5	30·0		10	0·9	3·6		2·5	0·65	1·5
11				34	1·2	10·5		3·7		2·5		1·5
12				38		11		3·8		2·5		1·6
13				41		12	0·92	3·9	0·8	2·5	0·67	1·6
14			1·65	14·0	1·25	12·7		4·1		2·5		
15				41		12·7		4·3		2·6		
16	1·49	29·2		38		12·7	0·97	4·6	0·82	2·7		
17		27·0	1·57	36·3		12·7		4·2		2·6		
18		25·0		36	1·25	12·7		3·8		2·5		
19	1·42	23·6		36		14	0·87	3·3		2·4		
20		26·0		36		15		3·1	0·77	2·3		
21		29·0	1·57	36·3	1·32	16·6		2·9		2·3		
22		32·0		36		19		2·7		2·3		
23	1·56	35·4		36		22	0·8	2·5	0·77	2·3		
24		33·0	1·56	35·4		25		2·5		2·2		
25		31·0		36	1·47	27·6		2·5		2·1		
26	1·48	28·4		37		32	0·8	2·5		2·0		
27		28·0		38		36		2·5	0·72	1·9		
28		27·0	1·6	39·0	1·62	41·0		2·4		1·8		
29		27·0		35		30		2·4		1·7		
30	1·46	26·8		30		18	0·77	2·3	0·67	1·6		
31			1·45	26·0				2·4		1·6		

Monte Creek (below Summit Lake Diversion.)

Location.—Section 22, township 18, range 14, west 6th meridian.

Records available.—May 25 to September 30, 1911; April 1 to September 17, 1912; June 20 to September 30, 1913.

Winter conditions.—Stream is usually frozen during winter months and, as a rule, there is no run-off during December, January, and February.

Gauge.—Vertical staff gauge with daily readings taken by Cecil Russell.

Channel.—Width of channel varies from 3 to 15 feet, the stream bed being gravelly. The flow varies from zero to 100 second-feet.

Discharge Measurements.—The gauge-height discharge curve is well defined by twelve meterings, most of which however were made at low medium stages.

Accuracy.—The accuracy of returns is high, but another meter measurement should be secured at a high stage during 1914.

Discharge Measurements of Monte Creek below Diversion Summit Lake.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
June 15	W. M. Carlyle	1,044	13·2	9·6	0·5	4·07	4·7
July 10	do	1,044	14·0	12·7	0·7	4·20	9·1
July 24	do	1,044	13·0	7·4	0·3	4·00	2·4
Aug. 18	do	1,044	3·5	1·3	0·5	3·83	0·6
1912							
May 11	C. E. Richardson	1,048	15·0	24·7	3·0	4·70	73·3
July 15	do	1,048	13·0	9·1	0·5	3·98	4·9
July 17	do	1,048	12·0	7·3	0·4	3·93	2·9
Aug. 27	do	1,048	13·0	4·2	0·4	3·74	1·6
1913							
April 24	H. J. E. Keys	1,057	14·0	13·2	0·8	4·17	11·0
June 20	do	1,057	14·0	11·9	1·1	4·18	12·8
Sept. 19	do	1,057	6·0	2·4	0·8	3·80	1·9[1]

Note.—[1]Different section.

Monthly Discharge of Monte Creek below Diversion Summit Lake for 1913.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
July	12·4	2·0	3·5	220
August	4·7	2·0	3·5	214
September	4·7	2·0	2·4	145

Daily Gauge Heights and Discharge of Monte Creek below Summit Lake Diversion for 1913.

Day.	April.		May.		June.		July.		August.		September.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
1							4·2	12·4	3·8	2·0	3·8	2·0
2							4·15	10·0	3·8	2·0	3·8	2·0
3							4·1	7·7	3·8	2·0	3·88	2·9
4							4·0	4·7	3·8	2·0	3·95	3·9
5							4·0	4·7	4·0	4·7	4·0	4·7
6							3·9	3·1	4·0	4·7	3·98	4·4
7							3·9	3·1	4·0	4·7	3·9	3·1
8							3·9	3·1	4·0	4·7	3·9	3·1
9							3·9	3·1	4·0	4·7	3·9	3·1
10							3·9	3·1	4·0	4·7	3·9	3·1
11							3·9	3·1	4·0	4·7	3·87	2·8
12							3·9	3·1	4·0	4·7	3·8	2·0
13							3·9	3·1	4·0	4·7	3·8	2·0
14							3·9	3·1	4·0	4·7	3·8	2·0
15							3·9	3·1	4·0	4·7	3·8	2·0
16							3·9	3·1	4·0	4·7	3·8	2·0
17							3·9	3·1	3·9	3·1	3·8	2·0
18							3·9	3·1	4·0	4·7	3·8	2·0
19							3·9	3·1	4·0	4·7	3·8	2·0
20					4·18	12·8	3·9	3·1	3·92	3·4	3·8	2·0
21							3·85	2·5	3·9	3·1	3·8	2·0
22					4·4	30·0	3·85	2·5	3·9	3·1	3·8	2·0
23					4·4	30·0	3·8	2·0	3·9	3·1	3·8	2·0
24					4·3	20·0	3·8	2·0	3·9	3·1	3·8	2·0
25	4·17	11·0			4·4	30·0	3·8	2·0	3·9	2·1	3·8	2·0
26					4·3	20·0	3·8	2·0	3·85	2·5	3·8	2·0
27					4·2	12·4	3·8	2·0	3·8	2·0	3·8	2·0
28					4·2	12·4	3·8	2·0	3·8	2·0	3·8	2·0
29					4·2	12·4	3·8	2·0	3·8	2·0	3·8	2·0
30					4·2	12·4	3·8	2·0	3·8	2·0	3·8	2·0
31							3·8	2·0	3·8	2·0		

MONTE CREEK DIVERSION TO SUMMIT LAKE.

Location.—Section 15, township 18, range 14, west 6th meridian.

Records Available.—May 25 to October 2, 1911; June 20 to September, 30, 1913.

Gauge.—Vertical staff gauge read daily during the irrigation season by C. Russell.

Channel.—The channel is about 10 feet in width, having a gravelly bed. This diversion supplements the natural run-off of Summit lake (or Essell) creek.

Discharge Measurements.—The new gauge established in 1913 has not yet been well rated, being defined by only three meterings.

Accuracy.—The accuracy is fair for discharges up to 12 second-feet. The deductions made for greater flow will be ratified during 1914 if possible.

MONTE CREEK DIVERSION TO SUMMIT LAKE.

The diversion is about half a mile long and the water flows into the north end of Summit lake. The headgate on Monte creek is about 12 miles from the mouth, and 100 yards above the hydrographic station called Monte Creek at Grahams ranch.

The gauge was established at the headgate. The water is changed from one channel to the other by moving logs and rocks. So every time the water is changed the gauging section is changed. In 1911 no changes were made, but

owing to the continual changing in 1912 no daily discharges were obtained. A new station was established and rated in 1913, and daily readings were obtained from May 20 to September 30.

DISCHARGE MEASUREMENTS of Monte Creek Diversion to Summit Lake, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 25	W. M. Carlyle	1,044	4·7	10·2	3·2	1·15	32·7
June 15	do	1,044	13·6	6·0	1·5	0·58	8·8
July 10	do	1,044	13·5	4·6	1·1	0·39	5·0
July 24	do	1,044	6·0	2·4	0·4	0·1	0·9
Aug. 18	do	1,044	2·0	0·6	0·4	0·03	0·2
1912							
May 11	C. E. Richardson	1,048	9·0	7·0	1·6	0·6	10·8
July 15	do	1,048	4·0	1·6	1·2	0·34	1·9
July 17	do	1,048	5·0	1·5	1·2	0·32	1·7
Aug. 27	do	1,049	3·0	0·7	0·6	0·18	0·4

MONTHLY DISCHARGE of Monte Creek Diversion to Summit Lake, for 1913.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
July	21·4	8·7	12·8	790
August	8·7	1·3	3·4	210
September	2·7	0·3	1·0	60

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DAILY GAUGE HEIGHTS AND DISCHARGES of Monte Creek Diversion to Summit Lake for 1913.

Day.	April.		May.		June.		July.		August.		September.	
	Gauge Height.	Discharge.	Gauge Height	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft
1							1·15	21·4	0·7	6·1	0·4	1·3
2							1·0	15·6	0·7	6·1	0·4	1·3
3							1·0	15·6	0·8	8·7	0·45	1·8
4							1·0	15·6	0·8	8·7	0·52	2·7
5							1·0	15·6	0·6	4·0	0·5	2·4
6							1·0	15·6	0·6	4·0	0·45	1·8
7							0·9	12·0	0·6	4·0	0·4	1·3
8							0·9	12·0	0·6	4·0	0·4	1·3
9							1·0	15·6	0·6	4·0	0·4	1·3
10							0·9	12·0	0·6	4·0	0·4	1·3
11							0·9	12·0	0·55	3·1	0·4	1·3
12							1·0	15·6	0·55	3·1	0·35	1·0
13							1·1	19·4	0·55	3·1	0·35	1·0
14							1·1	19·4	0·55	3·1	0·35	1·0
15							1·1	19·4	0·55	3·1	0·32	0·8
16							1·0	15·6	0·5	2·4	0·3	0·7
17							1·0	15·6	0·5	2·4	0·3	0·7
18							0·9	12·0	0·6	4·0	0·3	0·7
19							0·9	12·0	0·6	4·0	0·3	0·7
20					0·81	9·2	0·8	8·7	0·55	3·1	0·3	0·7
21							0·8	8·7	0·5	2·4	0·3	0·7
22					0·9	12·0	0·8	8·7	0·5	2·4	0·3	0·7
23					0·9	12·0	0·8	8·7	0·5	2·4	0·3	0·7
24	0·90	12·0			0·8	8·7	0·8	8·7	0·5	2·4	0·3	0·7
25					0·9	12·0	0·8	8·7	0·5	2·4	0·25	0·5
26					1·0	15·6	0·8	8·7	0·45	1·8	0·25	0·5
27					1·1	19·4	0·8	8·7	0·45	1·8	0·2	0·3
28					1·2	23·4	0·8	8·7	0·4	1·3	0·2	0·3
29					1·2	23·4	0·8	8·7	0·4	1·3	0·2	0·3
30					1·2	23·4	0·8	8·7	0·4	1·3	0·2	0·3
31							0·8	8·7	0·4	1·3		

NAHATLATCH RIVER (LOWER).

Location.—Section 7, township 2, range 26, west 6th meridian.

Records Available.—February 27, 1912, to December 31, 1913; January 1, 1913, to December 31, 1913.

Winter Conditions.—Open conditions exist throughout the winter.

Gauge.—Standard vertical staff gauge read weekly by C. Nicholson.

Channel.—There are rapids above and below the gauging section, where the current is slow and the water deep. The bed of the stream contains large boulders.

Discharge Measurements.—The gauge-height-discharge curve is well defined up to a discharge of 4,600 second-feet. Above this point it was necessary to project the curve during the freshet of 1913. An attempt will be made to have the deductions ratified during the coming season.

Accuracy.—The accuracy is high except for the period mentioned.

NAHATLATCH RIVER.

Nahatlatch river rises in the mountains north of Harrison lake outside the Railway belt, at an elevation of about 600 feet, and discharges into Fraser river at an elevation of 360 feet. It is part of the Fraser drainage. Douglas creek flows into the Nahatlatch from the south, and Log creek from the north. These two streams are close together, and only a short distance below the lakes.

The drainage area of the Nahatlatch at the upper measuring section, which is above the two tributaries, is 300 square miles; and the area above the mouth of the stream is 400 square miles. One very small tributary creek is used for irrigation, but the water of the main stream is not used in any way at present. The stream, however, has a good site for the development of water-power.

The upper part of the watershed of the Nahatlatch is rough and mountainous, with some peaks on which the snow remains until the fall. The country is timbered and some of the timber is very good. Near the lakes the valley is quite wide and for several miles above the lake the river flows quite slowly and sometimes overflows its banks and floods the hay meadows at the head of the lakes. The lakes themselves are at an elevation of 900 feet. There are four lakes in all, three of them being at practically the same elevation while the last is from 15 to 20 feet below. The three upper lakes are together seven miles long, while the lower is about half a mile, with half a mile of rapids between. The width varies from one quarter of a mile to a mile. The hills rise quite steeply from the water's edge except at the mouth of two or three creeks where there are deltas. Snow slides are quite frequent, and it is very hard to keep a trail open along the lakes. The lake is quite deep in most parts. There is good fishing in the lakes and in the rivers.

Below the lakes the river is a series of rapids, falling 550 feet in 8 miles. It is for this reason that no attempt has been made to run logs in the river. But with this fall it would be quite possible to develop a large amount of power. The lakes would provide the necessary storage. The great drawback to the scheme is the necessity for about seven miles of flume and pipeline necessitating a large expense for construction and considerable attention during operation to prevent damage from slides and falling timber. Probably as much as 30,000 horse power could be developed if desired.

There is some land being cultivated near the mouth of the Nahatlatch river. Fruit seems to do fairly well there. There is one home-steader about 4 miles up the valley, and there is no one beyond him. A few years ago, part of the hay meadow at the head of the lakes was taken up as a homestead. But a big log jam in the river caused the flooding of the meadows, and the house was washed away. Since that time no attempt has been made to cultivate that land. The use of the lakes for storage for power purposes will mean that this land will be flooded, and it is merely a matter of deciding which will be of greater value.

Gauging stations were established at two places on the Nahatlatch. One is at the outlet of the lakes and gives the flow from them. The other is two miles below the lakes and gives the total flow of the stream including the two tributaries, Douglas creek and Log creek which enter about half a mile below the lakes. The river is very rapid and the bed thickly strewn with large boulders, but by carefully choosing the section, blasting out some of the worst boulders and putting up cables and cars, two fairly good metering stations were obtained. Part of this work was done by engineers of the Canadian Pacific Railway Company who were investigating the power possibilities of the stream. Gauges were established and are being read by Chas. Nicholson, a prospector, who is the only person living in the Nahatlatch valley. He is 4 miles from the farthest gauge and makes the trip once a week. The stations were established on February 26, 1912, and weekly gauge readings have been taken at both stations continuously since that date.

The upper station is 8 miles west of Keefers station, and 200 yards east of the lowest of the Nahatlatch lakes. There is a chain gauge of No. 12 steel Jack chain with a 6 pound sash weight. The chain runs over a pulley on the end of a log, supported against two trees, and overhanging the stream. It is referred to three permanent bench-marks. For the meter measurements there is a half-inch steel cable stretched across the stream and supported by trees

On each bank. A substantial car is suspended from the cable by means of two heavy snatch blocks. The engineer can thus place himself directly over any part of the section and take measurements with a meter suspended by its cable. The channel above the station is straight for 100 feet with the water flowing smoothly. About 400 feet above the section there are rapids when the water leaves the lake. Below the section the channel is straight for 100 feet and then the rapids commence again. The right bank is 100 feet high with a steep slope. The left bank is 50 feet high, with a fairly steep slope, and with bushes and trees above the high-water mark. The bed of the stream is covered with rocks and boulders and these make it rather difficult to get accurate measurements. There is only one channel, about 4 feet deep at low water.

Discharge Measurements of Nahatlatch River near Lower Station, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
June 26	Chisholm & Cline	1,044	95	747	6·47	6·4	4,640
July 4	K. G. Chisholm	1,055	93	627	5·09	4·95	3,196
Sept. 21	do	1,055	80	431	2·96	2·63	1,273
1912							
July 23	C. G. Cline					3·75	1,920
Nov. 28	do					2·20	891

Monthly Discharge of Nahatlatch River near Lower Station for 1913.

(Drainage area, 400 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	370	281	328	0·82	0·95	20,168
February	410	230	298	0·74	0·77	16,550
March	295	240	275	0·69	0·79	16,900
April	1,680	271	914	2·28	2·54	54,387
May	6,148	730	3,149	7·87	9·07	193,700
June	6,350	4,100	5,074	12·68	14·15	302,000
July	4,520	3,022	3,661	9·15	10·55	225,000
August	3,086	1,525	2,083	5·21	6·01	127,900
September	2,880	830	1,732	4·33	4·83	103,000
October	2,927	841	1,466	3·66	4·22	90,000
November	1,140	685	887	2·22	2·48	52,780
December	855	450	578	1·41	1·66	35,540
Year	6,350	230	1,704	51·09	58·02	1,237,934

Daily Gauge Heights and Discharges of Nahatlatch River, near Lower Station for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec. ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	370	.....	273	.....	247	.....	271	.....	937	8·00	6,350
2	.....	370	·65	265	·55	240	.....	273	.....	868	.....	6,310
3	.....	370	.....	260	.....	246	.....	275	.....	799	.....	6,270
4	1·0	370	.....	255	.....	252	.....	277	1·90	730	.....	6,231
5	.....	365	.....	250	.....	258	.....	279	.....	1,092	.....	6,192
6	.....	360	.....	245	.....	264	·70	280	.....	1,454	.....	6,153
7	.....	355	.....	240	.....	269	.....	344	.....	1,816	.....	6,114
8	.....	349	.....	235	.....	274	.....	408	.....	2,178	7·75	6,075
9	.....	343	·50	230	·70	280	.....	472	.....	2,540	.....	5,852
10	.....	337	.....	256	.....	282	.....	536	.....	2,902	.....	5,630
11	.....	331	.....	282	.....	284	.....	600	5·10	3,265	.....	5,408
12	·85	325	.....	308	.....	286	.....	665	.....	3,118	.....	5,186
13	.....	322	.....	334	.....	288	1·90	730	.....	2,970	.....	4,964
14	.....	320	.....	359	.....	290	.....	865	.....	2,822	.....	4,742
15	.....	318	.....	384	.....	292	.....	1,000	.....	2,674	6·30	4,520
16	.....	316	1·10	410	·75	295	.....	1,136	.....	2,526	.....	4,460
17	.....	314	.....	394	.....	293	.....	1,272	.....	2,378	.....	4,400
18	.....	312	.....	378	.....	291	.....	1,408	4·00	2,230	.....	4,340
19	·80	310	.....	368	.....	289	.....	1,544	.....	2,617	.....	4,280
20	.....	312	.....	346	.....	287	3·35	1,680	.....	3,004	.....	4,220
21	.....	314	.....	329	.....	285	.....	1,613	.....	3,391	.....	4,160
22	.....	316	.....	312	.....	282	.....	1,546	.....	3,778	5·9	4,100
23	.....	318	·75	295	·70	280	.....	1,479	.....	4,165	.....	4,178
24	.....	320	.....	287	.....	277	.....	1,412	.....	4,552	.....	4,257
25	.....	322	.....	279	.....	274	.....	1,346	6·70	4,940	.....	4,336
26	·85	325	.....	271	.....	272	2·80	1,280	.....	5,141	6·20	4,416
27	.....	316	.....	263	.....	270	.....	1,212	.....	5,342	.....	4,625
28	.....	307	.....	255	.....	268	.....	1,144	.....	5,543	.....	4,835
29	.....	298	.....	.....	·65	265	.....	1,075	.....	5,744	6·80	5,045
30	.....	289	.....	.....	.....	267	.....	1,006	.....	5,946	.....	4,669
31	.....	281	.....	.....	.....	269	.....	.....	.....	6,148	.....	.....

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DAILY GAUGE HEIGHTS AND DISCHARGES of Nahatlatch River, near Lower Station for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1		4,293		3,086		1,852		810		763		855
2		3,917	4·80	2,975		2,023		790	1·8	685		820
3		3,541		2,870		2,194		770		719		785
4	5·00	3,165		2,765		2,365		750		753		750
5		3,370		2,660		2,536	1·9	730		787		715
6	5·40	3,575		2,556		2,708		1,043		821		680
7		3,496		2,452	4·70	2,880		1,357		854	1·7	645
8		3,417		2,348		2,745		1,671		887		628
9		3,338		2,244		2,610		1,985	2·25	920		610
10		3,259	3·90	2,140		2,475		2,299		952		592
11		3,180		2,052		2,340		2,613		984		574
12		3,101		1,964		2,205	4·75	2,927		1,016		556
13	4·85	3,022		1,876		2,070		2,687		1,047		538
14		3,236		1,788		1,935		2,447		1,078	1·4	520
15		3,450		1,700	3·50	1,800		2,207		1,109		515
16		3,664		1,612		1,696		1,967	2·6	1,140		510
17		3,878	3·15	1,525		1,592		1,726		1,081		504
18		4,092		1,607		1,488		1,485		1,022		498
19		4,306		1,689		1,384	2·75	1,245		963		492
20	6·30	4,520		1,770		1,280		1,256		905		486
21		4,397		1,851	2·65	1,175		1,267		847	1·3	480
22		4,275		1,932		1,127		1,278		789		475
23		4,153		2,013		1,079		1,290	1·9	730		470
24		4,031	3·85	2,095		1,031		1,302		752		466
25		3,909		2,035		984	2·85	1,315		775		462
26		3,786		1,975		937		1,236		798		458
27		3,663		1,916	2·20	890		1,157		821		454
28		3,540		1,857		870		1,078		844	1·2	450
29	5·25	3,417		1,798		850		999		867		549
30		3,307		1,739		830		920	2·2	890		648
31		3,197	3·35	1,680				841				747

NAHATLATCH RIVER (UPPER STATION) NEAR KEEFERS.

Location.—Section 14, township 12, range 27, west 6th meridian.

Records Available.—February 26 to December 31, 1912; January 1 to December 31, 1913.

Winter Conditions.—Open conditions exist throughout the winter.

Gauge.—There is a chain gauge at which weekly records are taken by Chas. Nicholson.

Channel.—The channel is straight, with rapids a short distance above and below the gauge.

Discharge Measurements.—Meterings are made from a cable car, and the gauge-height-discharge curve is well defined up to a discharge of 3,600 feet. The curve has been projected above that point.

Accuracy.—The accuracy is fair except for the short period at the peak of the freshet. The deductions made for this period will, it is expected, be ratified during the coming season.

Discharge Measurements of Nahatlatch River, at Upper Station, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
June 26	C. G. Cline	1,044	120	764	5·0	8·1	3,659
Sept. 21	K. G. Chisholm	1,055	85	437	2·37	5·1	1,036
1912.							
Feb. 25	C. G. Cline	1,046	65	256	1·6	3·45	417
July 18	do	1,046	105	530	3·6	6·35	1,930
Nov. 28	do	1,048	80	381	2·1	4·35	817

Monthly Discharge of Nahatlatch River at Upper Station, for 1913.

(Drainage area, 300 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	447	377	401	1·34	1·54	24,650
February	535	345	420	1·40	1·46	23,300
March	395	360	372	1·24	1·43	22,870
April	1,465	360	869	2·89	3·22	51,700
May	4,953	730	2,552	8·51	9·81	156,900
June	5,120	3,450	4,222	14·07	15·70	251,200
July	4,220	2,710	3,361	11·20	12·91	206,600
August	2,695	1,280	1,835	6·12	7·06	112,830
September	2,610	828	1,560	5·20	5·80	92,830
October	2,510	809	1,318	4·39	5·06	81,160
November	1,160	710	860	2·87	3·20	51,173
December	921	535	649	2·16	2·49	39,905
Year	5,120	345	1,535	5·12	69·68	1,115,118

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Daily Gauge Heights and Discharges of Nahatlatch River at Upper Station for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	412	.....	387	.....	370	.....	360	.....	895	9·4	5,120
2	.....	412	3·35	377	3·30	360	.....	360	.....	840	.....	5,103
3	.....	412	.....	372	.....	363	.....	360	.....	785	.....	5,086
4	3·45	412	.....	367	.....	366	.....	360	4·3	730	.....	5,069
5	.....	407	.....	362	.....	369	.....	360	.....	1,020	.....	5,052
6	.....	402	.....	357	.....	371	3·3	360	.....	1,310	.....	5,035
7	.....	397	.....	353	.....	373	.....	413	.....	1,600	.....	5,017
8	.....	393	.....	349	.....	375	.....	466	.....	1,890	9·3	5,000
9	.....	389	3·25	345	3·35	377	.....	519	.....	2,180	.....	4,818
10	.....	385	.....	373	.....	380	.....	572	.....	2,470	.....	4,636
11	.....	381	.....	400	.....	383	.....	625	7·25	2,760	.....	4,454
12	3·55	377	.....	427	.....	386	.....	678	.....	2,598	.....	4,272
13	.....	377	.....	454	.....	389	4·3	730	.....	2,436	.....	4,090
14	.....	377	.....	481	.....	391	.....	835	.....	2,274	.....	3,908
15	.....	377	.....	508	.....	393	.....	940	.....	2,112	8·15	3,725
16	.....	377	3·8	535	3·40	395	.....	1,045	.....	1,950	.....	3,685
17	.....	377	.....	520	.....	390	.....	1,145	.....	1,788	.....	3,645
18	.....	377	.....	505	.....	385	.....	1,255	5·95	1,627	.....	3,606
19	3·35	377	.....	490	.....	380	.....	1,360	.....	1,958	.....	3,567
20	.....	387	.....	475	.....	375	5·7	1,465	.....	2,289	.....	3,528
21	.....	397	.....	460	.....	370	.....	1,415	.....	2,620	.....	3,489
22	.....	407	.....	445	.....	365	.....	1,365	.....	2,951	7·9	3,450
23	.....	417	3·50	430	3·30	360	.....	1,315	.....	3,282	.....	3,560
24	.....	427	.....	420	.....	360	.....	1,265	.....	3,613	.....	3,670
25	.....	437	.....	410	.....	360	.....	1,215	8·35	3,945	.....	3,780
26	3·55	447	.....	400	.....	360	.....	1,165	.....	4,113	8·3	3,890
27	.....	437	.....	390	.....	360	5·1	1,115	.....	4,281	.....	4,000
28	.....	427	.....	380	.....	360	.....	1,060	.....	4,449	.....	4,110
29	.....	417	.....	.....	3·30	360	.....	1,005	.....	4,617	8·6	4,220
30	.....	407	.....	.....	.....	360	.....	950	.....	4,735	.....	4,000
31	.....	397	.....	.....	.....	360	.....	.....	.....	4,953	.....	.....

DAILY GAUGE HEIGHTS AND DISCHARGES of Nahatlatch River at Upper Station for 1913—*Continued.*

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	3,952	.....	2,695	.....	1,685	.....	809	.....	767	.....	921
2	.....	3,818	7·1	2,610	.....	1,840	.....	795	4·5	710	.....	882
3	.....	3,685	.....	2,518	.....	1,994	.....	781	.....	713	.....	843
4	.....	3,552	.....	2,426	.....	2,148	.....	767	.....	716	.....	804
5	.....	3,419	.....	2,235	.....	2,302	4·35	752	.....	719	.....	766
6	7·75	3,285	.....	2,244	.....	2,456	.....	1,003	.....	722	.....	728
7	.....	3,202	.....	2,153	7·1	2,610	.....	1,254	.....	725	4·2	690
8	.....	3,120	.....	2,062	.....	2,465	.....	1,505	.....	728	.....	679
9	.....	3,038	.....	1,971	.....	2,320	.....	1,756	4·3	730	.....	667
10	.....	2,956	6·3	1,880	.....	2,175	.....	2,007	.....	792	.....	655
11	.....	2,876	.....	1,794	.....	2,030	.....	2,258	.....	854	.....	644
12	.....	2,792	.....	1,708	.....	1,885	7·0	2,510	.....	916	.....	632
13	7·2	2,710	.....	1,622	.....	1,740	.....	2,310	.....	977	.....	621
14	.....	2,926	.....	1,536	5·9	1,595	.....	2,110	.....	1,038	4·0	610
15	.....	3,142	.....	1,455	.....	1,526	.....	1,911	.....	1,099	.....	604
11	.....	3,358	.....	1,370	.....	1,457	.....	1,712	5·0	1,160	.....	598
17	.....	3,574	5·4	1,289	.....	1,388	.....	1,513	.....	1,099	.....	592
18	.....	3,789	.....	1,366	.....	1,320	.....	1,314	.....	1,038	.....	580
19	.....	4,005	.....	1,452	.....	1,252	5·1	1,115	.....	977	.....	580
20	8·6	4,220	.....	1,538	.....	1,184	.....	1,125	.....	916	.....	575
21	.....	4,063	.....	1,624	5·1	1,115	.....	1,134	.....	854	3·9	570
22	.....	3,906	.....	1,710	.....	1,073	.....	1,143	.....	792	.....	565
23	.....	3,749	.....	1,795	.....	1,031	.....	1,152	4·3	730	.....	566
24	.....	3,592	6·3	1,880	.....	1,989	.....	1,161	.....	762	.....	555
25	.....	3,435	.....	1,830	.....	947	5·2	1,170	.....	795	.....	550
26	.....	3,278	.....	1,780	.....	906	.....	1,112	.....	828	.....	545
27	7·6	3,120	.....	1,730	4·6	865	.....	1,054	.....	861	.....	540
28	.....	3,035	.....	1,680	.....	851	.....	996	.....	894	3·8	535
29	.....	2,950	.....	1,630	.....	837	.....	938	.....	927	.....	603
30	.....	2,865	.....	1,589	.....	823	.....	881	4·8	960	.....	671
31	.....	2,780	.....	1,539	.....	.....	.....	824	.....	.....	.....	739

Nicola River at Merritt.

Locations.—The station is located just below the town of Merritt on the Nicola Valley branch of the C. P. R., below the confluence of the Coldwater and Nicola rivers.

Data Available.—June 16, 1911, to December 31, 1911; January 31, 1912, to December 31, 1912; January 1, 1913, to December 31, 1913.

Winter Conditions.—Practically open-flow throughout the entire season.

Gauge.—Vertical staff gauge read tri-weekly by Miss Seaton.

Channel.—The bed of the stream is gravelly and the flow is in two channels during high stages.

Discharge Measurements.—Ten well-distributed measurements have been obtained and the stream is well rated.

Accuracy.—The accuracy is high and is considered to be within 10 per cent of actual conditions obtaining.

NICOLA RIVER AT MERRITT.

The Nicola river has its source in Nicola lake at an elevation of 2,020 feet and discharges into the Thompson at Spences Bridge at an elecation of 700 feet.

The chief tributaries are: from the left, going upstream, Skuhun creek, Guichon creek, Clapperton creek; from the right, going upstream, Agate creek,

Spius creek and Coldwater river. The drainage area above the mouth, from the Geological Survey map, scale 3 miles to 1 inch, is 2,650 square miles above the mouth and 1,500 miles above the confluence of the Coldwater.

The station at Merritt, which is just below the confluence of the Clearwater, was established in June, 1911, and continuous gauge readings have been taken since June 19, 1911, by C. A. Seaton.

Discharge Measurements of Nicola River at Merritt, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 14	H. J. E. Keys	1057	53	292	4·7	6·45	1,366

Note.—Gauge reader—Miss Seaton.

Monthly Discharge of Nicola River at Merritt for 1913.

(Drainage area, 1,500 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	46	29	33	0·02	·02	2,029
February	157	29	87	0·06	0·06	4,832
March	125	46	84	0·06	0·07	5,165
April	543	46	256	0·17	0·19	15,233
May	2,915	353	1,318	0·88	1·01	81,040
June	4,115	974	1,755	1·17	1·30	104,430
July	932	174	504	0·34	0·39	30,990
August	288	57	147	0·10	0·11	9,039
September	228	42	109	0·07	0·08	6,486
October	443	22	151	0·10	0·11	9,285
November	157	67	97	0·06	0·07	5,772
December	95	5	36	0·02	0·02	2,214
The year	4,115	5	381	0·25	3·43	276,515

Daily Gauge Heights and Discharges of Nicola River at Merritt for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	46	4·55	37	4·9	125	.....	46	.....	375	.....	3,215
2	4·6	46	.....	37	.....	118	4·6	46	5·5	353	8·2	3,515
3	.....	42	4·55	37	4·85	110	.....	46	.....	353	8·5	4,115
4	4·55	37	.....	33	.....	110	4·6	46	5·5	353	.....	3,515
5	.....	33	4·5	29	4·85	110	.....	46	.....	353	7·9	2,915
6	4·5	29	.....	29	.....	103	4·6	46	5·5	353	.....	2,437
7	.....	29	4·5	29	4·8	95	.....	46	.....	423	7·4	1,960
8	4·5	29	.....	29	.....	95	4·6	46	5·8	494	.....	1,960
9	.....	29	4·5	29	4·8	95	.....	46	6·3	782	7·4	1,960
10	4·5	29	.....	33	.....	95	4·6	46	6·7	1,102	.....	1,887
11	.....	29	4·55	37	4·8	95	.....	78	.....	1,058	7·3	1,805
12	4·5	29	.....	46	.....	95	4·85	110	6·6	1,015	.....	1,730
13	.....	29	4·65	56	4·8	95	.....	150	.....	973	7·2	1,655
14	4·5	29	.....	98	.....	95	5·1	190	6·5	932	.....	1,425
15	.....	29	4·95	141	4·8	95	.....	209	.....	893	6·8	1,195
16	4·5	29	.....	149	.....	76	5·2	228	6·4	855	.....	1,105
17	.....	29	5·0	157	4·7	67	.....	269	.....	893	6·6	1,015
18	4·5	29	.....	149	.....	74	5·4	310	6·5	932	.....	1,210
19	.....	29	4·95	141	4·75	81	.....	426	.....	974	7·0	1,405
20	4·5	29	.....	133	.....	74	5·9	543	6·6	1,015	.....	1,405
21	.....	29	4·9	125	4·7	67	.....	519	.....	1,213	7·0	1,405
22	4·5	29	.....	125	.....	67	5·8	494	7·0	1,405	.....	1,300
23	.....	29	4·9	125	4·7	67	.....	494	7·25	1,730	6·8	1,195
24	4·5	29	.....	125	.....	67	5·8	494	7·6	2,320	.....	1,148
25	.....	33	4·9	125	4·7	67	.....	494	7·8	2,715	6·7	1,102
26	4·55	37	.....	125	.....	67	5·8	494	.....	2,815	.....	1,060
27	.....	37	4·9	125	4·7	67	.....	469	7·9	2,915	6·6	1,015
28	4·55	37	.....	125	.....	67	5·7	443	.....	2,815	.....	1,015
29	.....	37	.....	.....	4·7	67	.....	420	7·8	2,715	6·6	1,015
30	4·55	37	.....	.....	.....	57	5·6	397	.....	2,815	.....	974
31	.....	37	.....	.....	4·6	46	.....	.....	7·9	2,915	.....	.....

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DAILY GAUGE HEIGHTS AND DISCHARGES of Nicola River at Merritt for 1913.
—*Continued*

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	6·5	932	.....	277	4·6	46	4·55	37	.....	95	.....	95
2	.....	894	5·35	288	.....	71	.....	33	4·8	95	4·8	95
3	6·4	855	.....	258	4·8	95	4·5	29	.....	95	.....	81
4	.....	819	5·2	228	.....	126	.....	25	4·8	95	4·7	67
5	6·3	782	.....	209	5·0	157	4·45	22	.....	88	.....	56
6	.....	750	5·1	190	.....	192	.....	22	4·75	81	4·6	46
7	6·2	715	.....	174	5·2	228	4·45	22	.....	74	.....	70
8	.....	683	5·0	157	.....	209	.....	90	4·7	67	4·8	95
9	6·1	652	.....	157	5·1	190	5·0	157	.....	67	.....	55
10	.....	637	5·0	157	.....	174	.....	300	4·7	67	4·4	15
11	6·05	623	.....	157	5·0	157	5·7	443	.....	67	.....	10
12	.....	596	5·0	157	.....	141	.....	398	4·7	67	4·2	5
13	5·95	569	.....	157	4·9	125	5·5	353	.....	67	.....	17
14	.....	544	5·0	157	.....	125	.....	290	4·7	67	4·5	29
15	5·85	519	.....	141	4·9	125	5·2	228	.....	81	.....	37
16	....	494	4·9	125	.....	110	.....	192	4·8	95	4·6	46
17	5·75	468	.....	141	4·8	95	5·0	157	.....	126	.....	37
18	.....	444	5·0	157	.....	95	.....	141	5·0	157	4·5	29
19	5·65	420	.....	157	4·8	95	4·9	125	.....	141	.....	22
20	.....	386	5·0	157	.....	88	.....	141	4·9	125	4·4	15
21	5·5	353	.....	141	4·75	81	5·0	157	.....	110	.....	10
22	.....	331	4·9	125	.....	74	.....	157	4·8	95	4·3	5
23	5·4	310	.....	110	4·7	67	5·0	157	.....	95	.....	5
24	.....	293	4·8	95	.....	67	.....	149	4·8	95	4·3	5
25	5·3	267	.....	88	4·7	67	4·95	141	.....	110	.....	10
26	.....	220	4·75	81	.....	67	.....	133	4·9	125	4·4	15
27	5·05	174	.....	74	4·7	67	4·9	125	.....	125	.....	22
28	.....	191	4·7	67	.....	57	.....	125	4·9	125	4·5	29
29	5·15	209	.....	67	4·6	46	4·9	125	.....	110	.....	29
30	.....	238	4·7	67	.....	42	.....	110	4·8	95	4·5	29
31	5·3	267	.....	57	.....	.....	.....	95	.....	.....	.....	29

NICOLA RIVER (MOUTH).

Location.—Section 1, township 17, range 25, west 6th meridian.

Records Available.—August 1 to December 1, 1911; April 5 to December 21, 1912; May 9 to December, 11, 1913.

Winter Conditions.—Not very severe. Stream is usually under ice cover during January and February.

Gauge.—Inclined staff gauge bolted to a large rock on the stream's right bank, and referred to bench-marks. Tri-weekly readings are obtained by Miss Violet Curnow.

Channel.—Stream is 100 to 150 feet in width, and has a rock and gravel bed. Flow varies from 150 to 5,000 c.f.s., and in gauge heights is 6 feet.

Discharge Measurements.—The gauge-height-discharge curve is defined by well-distributed measurements.

Accuracy.—The curve is excellently defined up to a discharge of 4,000 second-feet, which represents the maximum flow for an average year. Above this point the curve is projected for the season of 1913 when a maximum of 5,300 second-feet, was recorded. The accuracy of the whole is very high.

NICOLA RIVER AT MOUTH.

The Nicola river rises in Nicola lake at an elevation of 2,020 feet, and discharges into the Thompson river near Spences Bridge, at an elevation of 700 feet.

The mean annual precipitation over the whole drainage area is very small, not exceeding 15 inches. The area of the watershed is 2,650 square miles, 1,500 square miles of which is about 45 miles long and rises in Nicola lake, at an elevation of 2,020 feet. Nicola lake is 10 miles long and from half a mile to $1\frac{1}{2}$ miles wide. It is fed chiefly by the following streams:

(1) Guichon creek, which rises in the hills 15 miles south of Nicola lake, at an elevation of 3,000 feet.

(2) The upper Nicola river rises in the Trepanage plateau some 25 miles southeast of Nicola lake at an elevation of 4,000 feet. Chaperon and Douglas lakes are both tributaries of this stream.

(3) Stump lake and its tributaries 10 miles north-east of Nicola lake.

(4) Moore Creek, which rises in the hills 10 miles north of Nicola lake.

From Nicola lake the Nicola river flows in a southerly and westerly direction for 7 miles to Merritt, where it is joined by the Coldwater river. The Coldwater river is a large and flashy stream, draining 360 miles of country south of Merritt, and rising on the east slope of Anderson river mountain at an elevation of 4,000 feet. From Merritt the Nicola river flows in a northwesterly direction for 40 miles to discharge into the Thompson river at Spences Bridge, at an elevation of 650 feet. Thirty-five miles from the mouth, at Lower Nicola, Guichon creek enters. Guichon creek is a very contentious irrigation stream, and drains 475 square miles of land, a large percentage of which is suitable for cultivation, (See Gazetteer on Guichon creek.) Twenty-nine miles from the mouth, at Canford, Spius creek flows into the Nicola river. Spius creek drains 160 square miles of land east of Canford, rising 10 miles northwest of the source of the Coldwater river, at an elevation of 3,500 feet.

The Nicola Valley is a famous ranching country, the rolling hills being suitable for grazing lands. Possibly the most celebrated district in the valley is the Douglas lake country. Here some 100,000 acres of land is controlled by one large company, known as the Douglas Lake Cattle Company.

Good agricultural districts are scattered all through the Nicola river drainage. On Guichon creek alone probably 20,000 acres of land are under cultivation. The land around Nicola lake is all taken up. All through the valley, however, in dry seasons there is a scarcity of water, not so much due to the lack of water but to the lack of system in properly ulitizing the water, and good ditches.

Considerable mining is carried on in the Nicola valley. At Merritt three coal mines are in operation, and in the vicinity several rich gypsum claims have been recorded.

Practically all water-power possibilities of Nicola river proper have been eliminated by the presence of the C.P.R. Nicola Valley branch. This railroad follows the river between Spences Bridge and Merritt, and any development would interfere with the present right of way. There is small industrial power on Spius creek, but any installation would be expensive. The Coldwater river affords similar opportunities to Spius creek, but the power all through the valley is very limited.

There are two stations on Nicola river. The upper one at Merritt was established on June 17, 1911, by C. E. Richardson, and readings have been taken during 1911, 1912, and 1913.

The measuring section is located on the upstream side of the highway bridge, immediately below the mouth of the Coldwater river. Merritt station is slightly over 1 mile distant from the C.P.R. track. Measurements are made by cable suspension.

The gauge is a 6-foot standard vertical staff gauge. It is nailed to the right abutment of the bridge on its upstream side.

The stream is confined between the bridge abutment to one channel, whose bed is gravelly.

The elevation of the south rail of the C. P. R. Spences Bridge to Nicola Branch at the crossing of the road to Collettsville is 15·03 feet above the datum of the gauge.

The station at the mouth of Nicola river was established on June 19, 1911, by C. E. Richardson. The measuring section is located 200 yards from the mouth of the river on the upstream side of the highway bridge. Measurements are made by cable suspension. The gauge is an inclined staff bolted to a large rock on the right bank of the stream about six hundred yards above the measuring section.

The river is always confined to one channel, whose bed is rock and gravel with no vegetation. During high stages of the Thompson river water is backed up to the measuring section, but not to the gauge.

Discharge Measurements of Nicola River at Mouth, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 9	K. G. Chisholm	1044	130	490	5·44	5·49	2,586
June 7	do	1055	150	778	5·34	6·65	4,159
August 12	do	1055	113	194	2·11	2·5	410

Monthly Discharge of Nicola River at Mouth for 1913.

(Drainage area, 2,650 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	5,375	2,380	3,484	1·31	1·52	214,220
June	5,375	2,576	3,619	1·36	1·52	215,340
July	2,423	730	1,302	0·49	0·57	80,050
August	700	180	402	0·15	0·17	24,718
September	1,965	180	603	0·23	0·25	35,881
October	725	180	444	0·17	0·19	27,300
November	544	356	439	0·17	0·18	26,122
December	.....	.....	220	0·08	0·09	13,527
The period	5,375	180	1,314	0·49	4·49	637,158

Daily Gauge Heights and Discharges of Nicola River at Mouth for 1913.

Day.	May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	7·4	5,375
2	.....	.....	.....	5,251
3	.....	.....	.....	5,144
4	.....	.....	.....	5,037
5	.....	.....	7·2	4,925
6	.....	.....	.....	4,486
7	.....	.....	6·6	4,050
8	.....	.....	.....	4,050
9	5·3	2,380	.....	4,050
10	.....	2,416	6·6	4,050
11	.....	2,452	.....	3,750
12	5·4	2,490	.....	3,450
13	.....	2,520	.....	3,150
14	.....	2,550	5·7	2,850
15	.....	2,580	.....	2,850
16	5·5	2,610	.....	2,850
17	.....	2,650	5·7	2,850
18	.....	2,690	.....	3,242
19	5·6	2,730	6·3	3,635
20	.....	2,706	.....	3,590
21	.....	2,682	.....	3,545
22	.....	2,660	6·2	3,500
23	6·3	3,635	.....	3,282
24	.....	4,070	.....	3,066
25	.....	4,505	5·7	2,850
26	.....	4,940	.....	2,820
27	7·5	5·375	.....	2,790
28	.....	5,375	.....	2,760
29	.....	5,375	5·6	2,730
30	.....	5,375	.....	2,576
31	.....	5,375	.....	.....

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DAILY GAUGE HEIGHTS AND DISCHARGES of Nicola River at mouth for 1913.
—*Continued.*

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	2,423	.....	700	.....	180	.....	216	.....	544	.....	337
2	5·2	2,270	.....	671	1·8	180	1·9	210	.....	525	2·2	300
3	.....	2,147	.....	642	.....	890	.....	195	.....	506	.....	276
4	.....	2,023	.....	613	4·5	1,600	1,8	180	.....	487	.....	253
5	.....	1,899	.....	584	4·9	1,965	.....	180	.....	468	.....	232
6	4·7	1,775	.....	555	.....	1,650	.....	180	.....	449	1·9	210
7	.....	1,665	.....	526	.....	1,335	1·8	180	.....	430	.....	187
8	.....	1,555	.....	497	3·7	1,020	.....	200	.....	411	.....	174
9	4·3	1,445	.....	468	.....	905	.....	220	.....	392	.....	161
10	.....	1,407	.....	439	.....	790	2·0	240	.....	373	.....	158
11	.....	1,369	2·5	410	3·1	675	.....	280	.....	354	1·65	145
12	.....	1,332	.....	382	.....	602	.....	320	2·3	335	.....	.....
13	4·1	1,295	.....	354	2·8	530	.....	360	.....	415	.....	.....
14	.....	1,258	.....	327	2·9	575	.....	400	.....	495	.....	.....
15	.....	1,222	2·2	300	.....	506	.....	440	2·9	575	.....	.....
16	.....	1,186	.....	323	.....	438	.....	480	.....	553	.....	.....
17	3·9	1,150	.....	346	2·4	370	.....	521	.....	531	.....	.....
18	.....	1,120	2·4	370	.....	359	.....	562	.....	509	.....	.....
19	.....	1,090	.....	430	.....	347	.....	603	.....	487	.....	.....
20	.....	1,060	2·7	490	2·3	335	.....	644	.....	465	.....	.....
21	.....	1,030	2·5	410	.....	335	.....	685	.....	443	.....	.....
22	.....	1,000	.....	355	.....	335	3·2	725	.....	421	.....	.....
23	.....	970	2·2	300	.....	335	.....	715	.....	399	.....	.....
24	.....	940	.....	300	2·3	335	.....	696	.....	377	.....	.....
25	.....	910	.....	300	.....	304	.....	677	.....	356	.....	.....
26	.....	880	2·2	300	.....	272	.....	658	2·3	335	.....	.....
27	.....	850	.....	270	2·0	240	.....	639	.....	360	.....	.....
28	.....	820	.....	240	.....	234	.....	620	.....	385	.....	.....
30	.....	790	.....	210	.....	228	.....	601	2·5	410	.....	.....
30	.....	760	1·8	180	.....	222	.....	582	.....	374	.....	.....
31	.....	730	.....	180	.....	.....	.....	563	.....	.....	.....	.....

NISKONLITH CREEK NEAR SHUSWAP.

Location.—Section 5, township 21, range 13, west 6th meridian, below Niskonlith lake.

Records Available.—September 1 to December 1, 1911; April 1 to September 13, 1912; May 1 to September 30, 1913.

Winter Conditions.—Some short cold spells during the winter. Stream is practically dry from November to March.

Gauge.—Vertical staff gauge read semi-weekly by Miss Violet Hoffman.

Channel.—The stream bed is composed of large rocks and boulders, the current is swift and the control good.

Discharge Measurements.—The curve is poorly defined for medium stages although meterings have been secured at high and low water.

Accuracy.—The accuracy on the whole cannot be vouched for until further meterings are obtained.

NISKONLITH CREEK.

Niskonlith creek, is a stream about 10 miles in length, 4 to 10 feet in width and varies from a few inches to 2 feet in depth. Its drainage area is 50 square miles. Its source is in the hills of township 22, range 14, west of the 6th meridian, the northern slope of which feeds McGillivary creek an important tributary of Louis creek. Niskonlith creek is little known and as yet unused above Niskon-

lith lake, an ideal storage reservoir 2 miles from South Thompson river at an elevation of 1,620 feet. The Indians of the Niskonlith reserve are the principal users, and the flow is well regulated by a dam installed by the Indian Department. It is capable of raising the level of Niskonlith lake, whose area is 1,000 acres, 8 feet, thus impounding 8,000 acre-feet which is however, much in excess of the normal run-off of the stream. The normal precipitation in the Niskonlith watershed is about 15 to 20 inches per annum.

There is sufficient water in Niskonlith creek for all users, and suggestion has been made that some of it might be applied to land in the Pemberton and Moulton Creek valleys.

A drop of over 500 feet in 2 miles between Niskonlith lake and the South Thompson indicated the possibility of a small power development. The mean flow, however is very small, but it might be augmented by diversion from a tributary of Adams lake.

The station was established on August 26, 1911, by C. G. Cline, and semi-weekly gauge readings taken during the remainder of the 1911 and the whole of the 1912 and 1913 irrigation season. The station is located about half a mile above the highway, along the South Thompson river, and half mile below Niskonlith lake. It is also half a mile below the intake for the Indian Reserve irrigation ditch.

The gauge is a 3 foot standard gauge, nailed to an inch birch on the right bank of the stream. It is nearly opposite an old deserted cabin, which stands on the flat. Measurements are made by wading. The banks are 3 to 5 feet in height, and the stream is confined to one channel, which varies in depth from a few inches to 2 feet. There are bench-marks, whose elevations are referred to the datum of the gauge.

Discharge Measurements of Niskonlith Creek near Shuswap for 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Aug. 28	C. G. Cline	1,046	10	9·2	0·5	0·66	4·43
1912.							
April 17	Cline & Dann	1,046	10	0·15	0·6	0·88	0·1
May 20	E. M. Dann	1,044	80	17·9	3·7	1·92	66·9

Monthly Discharge of Niskonlith Creek, near Shuswap for 1913.

(Drainage area, 50 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	26·5	3·0	13·5	0·26	0·30	830
June	38·0	26·5	33·4	0·66	0·74	1,990
July	30·2	0·4	8·1	0·16	0·18	500
August	17·5	0·4	11·9	0·24	0·28	730
September	15·0	10·5	11·7	0·24	0·26	700

Note.—Artificial control.

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DAILY GAUGE HEIGHTS AND DISCHARGES of Niskonlith Creek, near Shuswap, for 1913.

DAY.	May.		June.		July.		August.		September.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	3·0	.....	26·5	1·3	29·0	0·4	0·4	1·0	15
2	.....	3·0	.....	26·5	.....	29·3	.....	0·4	.....	14·6
3	.....	3·0	1·25	26·5	.....	29·6	.....	0·4	.....	14·2
4	.....	3·0	.....	30·0	.....	29·9	0·4	0·4	0·95	13·7
5	.....	3·0	.....	34·0	1·32	30·2	.....	0·4	0·95	13·2
6	.....	5·3	1·45	38·0	.....	30·2	.....	0·4	.....	12·8
7	.....	5·3	.....	38·0	.....	30·2	0·4	0·4	.....	12·5
8	.....	5·3	.....	38·0	0·45	0·9	....	0·4	0·92	12·2
9	.....	5·3	.....	38·0	.....	2·3	.....	0·4	.....	12·0
10	.....	5·3	1·45	38·0	.....	3·8	.....	0·4	.....	11·8
11	.....	8·1	.....	37·0	0·7	5·3	1·05	17·5	.....	11·6
12	0·8	8·1	....	36·0	.....	4·5	.....	17·5	0·9	11·5
13	.....	8·3	.....	36·0	.....	3·7	.....	17·5	.....	11·5
14	.....	8·5	1·4	35·0	0·6	3·0	1·05	17·5	.....	11·5
15	0·82	8·8	.....	35·0	.....	2·7	.....	17·5	0·9	11·5
16	.....	11·0	.....	35·0	.....	2·5	.....	17·5	.....	11·5
17	.....	13·0	.....	35·0	0·55	2·2	.....	17·5	.....	11·5
18	.....	15·0	1·4	35·0	.....	1·9	.....	17·5	0·9	11·5
19	.....	17·0	.....	34·0	.....	1·6	1·05	17·5	.....	11·3
20	1·1	20·0	.....	33·0	.....	1·3	.....	17·5	.....	11·1
21	.....	20·7	1·35	32·0	0·47	1·1	.....	17·5	.....	11·0
22	.....	21·3	.....	32·4	.....	1·0	1·05	17·5	0·88	10·8
23	1·15	22·0	.....	32·8	.....	0·8	.....	17·5	.....	10·7
24	.....	22·5	1·37	33·2	.....	0·7	.....	17·5	.....	10·6
25	.....	23·0	.....	32·7	0·42	0·6	.....	17·5	.....	10·5
26	.....	23·5	.....	32·2	.....	0·6	1·05	17·5	0·87	10·5
27	1·2	24·0	.....	31·7	.....	0·6	.....	17·5	.....	10·5
28	.....	24·8	1·32	31·2	0·42	0·6	.....	17·5	.....	10·5
29	.....	25·6	.....	30·5	.....	0·5	1·05	17·5	.....	10·5
30	1·25	26·5	.....	29·8	.....	0·5	.....	16·7	0·87	10·5
31	.....	26·5	.....	.....	0·4	0·4	.....	15·9	.....	.....

PAUL CREEK (BELOW PAUL LAKE.)

Location.—Northeast boundary Kamloops Indian Reserve No. 1.

Records Available.—July 1 to October 6, 1911; May 12 to September 25, 1912; May 18 to September 30, 1913.

Winter Conditions.—Stream usually becomes very low and freezes, or dries up completely during the winter.

Gauge.—Vertical staff gauge read at least once a week by E. R. Ridout.

Channel.—Channel is rocky and current very swift at high stages.

Discharge Measurements.—The gauge-height-discharge curve is fairly well defined, but owing to poor conditions for metering, the freshet flow is probably not deduced with the highest accuracy. The flow is artificially controlled by a dam on Paul Lake.

Accuracy.—With the exception of the flood period the accuracy of returns is high.

PAUL CREEK.

Paul creek has its source in township 20, range 14, west 6th meridian, at an elevation of 3,500 feet and, flowing in a westerly direction, discharges into the North Thompson river, near Kamloops, at an elevation of 1,140 feet. It is part of the North Thompson drainage; the drainage area, above the outlet of

Paul lake as measured from a Geological Survey map, dated 1895, scale 2 miles to 1 inch, is 110 square miles. The precipitation varies from 25 inches, in the hills at the source, to 10 inches at the mouth. Paul creek is a contentious irrigation stream, about 20 miles in length, varying from 5 to 25 feet in width, and from several inches to a foot in depth. The drainage basin of Paul creek is well timbered with British Columbia fir, and in the upper reaches, spruce and balm of gilead are to be found. The first record on the stream is held by the Indians of the Kamloops Indian reserve, and it is regrettable that this somewhat large share of the supply is not used to better advantage. Often at the height of the irrigation season, the Indian ditch may be seen discharging into the Thompson river, while their fertile land lies awaiting the water so necessary for successful production.

The surplus flow of the stream, after the Indians are supplied, is held by the Harper estate, 12 miles east of Kamloops on the South Thompson river. A dam has been built by them with the co-operation of the Indians on Paul lake for storage purposes, and is effective in impounding a good portion of the spring run-off of the drainage basin. The dam could, however, be much improved, and the whole run-off successfully stored.

In its upper reaches, Paul creek flows through several large marshes and hay meadows, which flood in the spring time. It has been suggested that if the channel of Paul creek were deepened as it passes through these meadows and marshes, evaporation would be materially decreased and the flow of Paul creek augmented.

The residents of upper Paul creek (east of Pinantan lake) can raise good crops in average years without the aid of irrigation, although water when judiciously applied is of much assistance.

Below Paul Lake.—The river station on Paul creek below Paul lake was established July 2, 1911, by C. G. Cline. The measuring section is in a flume just above the Harper estate, and I. R. diversion. A standard vertical staff gauge is located on the left bank 50 feet above the measuring section; all measurements are made by wading. This station was established to determine the flow from Paul lake.

Above Pinantan Lake—This station was established August 25, 1911, by C. G. Cline, but was abandoned at the end of the irrigation season of 1912. This station was unsatisfactory, as the stream overflowed its banks during high water.

Below Pinantan Lake.—This station was established June 13, 1912, by E. M. Dann. The measuring section is located on the down stream side of the highway bridge, 100 feet below the outlet of Pinantan lake; all measurements are made by wading. A standard vertical staff gauge is located on the down-stream side of the aforementioned bridge. This station was established to take the place of the one abandoned above the lake. Two measurements were taken in 1912. (See miscellaneous measurements on Paul creek.)

Discharge Measurements of Paul Creek below Paul Lake, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 7.....	H. J. E. Keys.....	1,057	5·5	5·0	7·8	2·40	39·2
" 28.....	E. M. Dann.....	268	5·5	8·2	11·0	2·70	90·7
Sept. 9.....	H. J. E. Keys.....	1,057	5·5	·76	6·6	1·65	5·0
" 16.....	Dann and Keys.....	1,057	6·0	3·4	1·8	1·59	[1]6·1

Note.—Gauge reader, E. R. Ridout.
[1] New measuring section.

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Monthly Discharge of Paul Creek, below Paul Lake, for 1913.

(Drainage area, 65 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
June	90	35	52·3	0·80	0·89	3,112
July	34	23	29	0·45	0·52	1,783
August	23	10	15	0·23	0·26	922
September	9	0·5	4·5	0·07	0·08	268

Daily Gauge Heights and Discharges of Paul Creek, below Paul Lake, for 1913.

Day.	May.		June.		July.		August.		September.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	2·7	90	.....	34	.....	23	.....	9
2	.....	.....	.....	86	.....	34	.....	23	.....	9
3	.....	.....	.....	82	.....	34	2·1	22	.....	9
4	.....	.....	.....	77	.....	33	.....	21	.....	8
5	.....	.....	.....	73	.....	33	.....	21	.....	8
6	.....	.....	.....	69	2·3	32	.....	20	.....	8
7	.....	.....	.....	64	.....	32	.....	20	1·65	7
8	.....	.....	2·6	60	.....	32	.....	19	.....	7
9	.....	.....	.....	58	.....	32	.....	19	.....	6
10	.....	.....	.....	56	.....	32	2·0	18	.....	6
11	.....	.....	.....	55	.....	31	.....	18	.....	5
12	.....	.....	.....	53	.....	31	.....	17	.....	5
13	.....	.....	.....	52	2·25	30	.....	17	.....	4
14	.....	.....	.....	50	.....	30	.....	16	1·5	3
15	.....	.....	2·5	48	.....	30	.....	16	.....	3
16	.....	.....	.....	47	.....	29	.....	15	.....	3
17	.....	.....	.....	46	.....	29	1·9	14	.....	3
18	2·6	60	.....	44	.....	28	.....	14	.....	3
19	.....	58	.....	43	.....	28	.....	13	.....	3
20	.....	56	.....	42	2·2	27	.....	13	.....	3
21	.....	55	.....	40	.....	27	.....	12	1·45	2·5
22	.....	53	2·4	39	.....	27	.....	12	.....	2
23	.....	52	.....	39	.....	26	.....	12	.....	2
24	.....	50	.....	38	.....	26	1·8	11	.....	2
25	2·5	48	.....	38	.....	25	.....	11	.....	1·5
26	.....	54	.....	37	.....	25	.....	11	.....	1·5
27	.....	60	.....	37	2·15	24	.....	11	.....	1
28	.....	66	.....	36	.....	24	.....	10	1·3	0·5
29	.....	72	2·35	35	.....	24	.....	10	.....	.....
30	.....	78	.....	35	.....	24	.....	10	.....	.....
31	.....	84	.....	.....	.....	23	1·75	10	.....	.....

PAUL CREEK (BELOW PINANTAN LAKE.)

Location.—Section 27, township 20, range 15, west 6th meridian.

Records Available.—June 1 to August 31, 1913.

Winter Conditions.—Stream generally freezes over during the winter months.

Gauge.—Vertical staff gauge read daily during the irrigation season by A. Pene.

Channel.—The channel varies in width from 3 to 15 feet. Together with Lloyd creek, this stream represents the chief source of supply for the Paul lake reservoir.

Discharge Measurements.—Three meterings only were taken and gauge-height-discharge curve is poorly defined.

Accuracy.—Very little reliance can be placed on the figures appended.

DISCHARGE MEASUREMENTS of Paul Creek below Pinantan Lake, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 6	H. J. E. Keys	1,057	12	12·4	1·3	1·57	16·3
Sept. 10	do	1,057	3	0·3	1·0	0·32	0·3
Oct. 6	do	1,057	3	0·3	1·0	0·30	0·3

MONTHLY DISCHARGE of Paul Creek below Pinantan Lake for 1913.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
June	5·2	2·7	3·93	234
July	4·5	1·0	2·59	159
August	1·8	0·1	0·70	43

NOTE.—Accuracy "D".
During low water Pinantan lake is practically dammed by boards to preserve the fishing.

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DAILY GAUGE HEIGHTS AND DISCHARGES of Paul Creek below Pinantan Lake, for 1913.

Day.	May.		June.		July.		August.		September.		October.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			0·9	5·2	0·8	3·9	0·5	1·0	0·2	0·2		
2			0·9	5·2	0·8	3·9	0·5	1·0	0·2	0·2		
3			0·9	5·2	0·85	4·5	0·55	1·4	0·25	0·2		
4			0·85	4·5	0·8	3·9	0·55	1·4	0·25	0·2		
5			0·8	3·9	0·8	3·9	0·5	1·0	0·2	0·2		
6	1·57	16·3	0·8	3·9	0·8	3·9	0·5	1·0	0·2	0·2	0·3	0·3
7			0·8	3·9	0·8	3·9	0·6	1·8	0·2	0·2		
8			0·8	3·9	0·8	3·9	0·6	1·8	0·2	0·2		
9			0·8	3·9	0·75	3·3	0·5	1·0	0·2	0·2		
10			0·8	3·9	0·75	3·3	0·5	1·0	0·3	0·3		
11			0·85	3·3	0·75	3·3	0·5	1·0	0·2	0·2		
12			0·75	3·3	0·8	3·9	0·55	1·4	0·2	0·2		
13			0·7	2·7	0·7	2·7	0·5	1·0	0·2	0·2		
14			0·7	2·7	0·7	2·7	0·4	0·5				
15			0·75	3·3	0·7	2·7	0·4	0·5				
16			0·75	3·3	0·7	2·7	0·45	0·8				
17			0·7	2·7	0·65	2·2	0·4	0·5				
18			0·8	3·9	0·65	2·2	0·4	0·5				
19			0·8	3·9	0·65	2·2	0·4	0·5				
20			0·8	3·9	0·6	1·8	0·3	0·3				
21			0·75	3·3	0·6	1·8	0·3	0·3				
22			0·8	3·9	0·6	1·8	0·35	0·4				
23			0·8	3·9	0·6	1·8	0·3	0·3				
24			0·8	3·9	0·6	1·8	0·25	0·2				
25	0·97	6·2	0·8	3·9	0·55	1·4	0·2	0·2				
26	0·97	5·2	0·85	4·5	0·55	1·4	0·2	0·2				
27	0·9	5·2	0·85	4·5	0·55	1·4	0·2	0·2				
28	0·9	5·2	0·85	4·5	0·5	1·0	0·2	0·2				
29	0·9	5·2	0·85	4·5	0·5	1·0	0·2	0·2				
30	0·9	5·2	0·85	4·5	0·5	1·0	0·15	0·1				
31	0·9	5·2			0·5	1·0	0·15	0·1				

SHUSWAP RIVER.

Location.—The gauging section is located in township 18, range 9, west 6th meridian at the highway bridge at Enderby, B.C.

Records Available.—March to November, 1912; April to December, 1913.

Winter Conditions.—The thermometer seldom goes below —10°F. The snowfall at Enderby is not heavy; the river is generally frozen for about three months.

Gauge.—A vertical staff gauge is used and read by Mr. P. Mowatt, daily.

Channel.—The channel is straight for 100 yards at section. The rise and fall in the river each year is about 10 feet. No shift in control is as yet appreciable.

Discharge Measurements.—Ten well distributed measurements have been made during 1911-12-13. Measurements are made from cable and boat, except in high water, when they are made from bridge.

Accuracy.—Accurate gauge readings are obtained, the discharge measurement plot up well; these results are within 5 per cent except in high water, when they may not be more accurate than within 10 per cent.

Discharge Measurements of Shuswap River near Enderby, 1911-13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Aug. 25	C. E. Richardson	1,048	212	2,118	0·92	4·08	1,948
Oct. 7	do	1,048	204	1,890	0·69	3·15	1,300
1912							
Feb. 28	C. E. Richardson	1,047	180	1,680	0·35	1·90	587
May 20	C. E. R. & H. C. H.	1,048	283	4,970	2·31	10·65	11,400
June 16	C. E. Richardson	1,048	332	5,550	2·36	12·05	13,094
July 13	do	1,048	275	3,760	1·67	7·34	6,270
Sept. 7	do	1,048	245	3,156	1·04	4·60	3,270
1913							
June 5	J. A. Elliott	1,672	328	7,016	2·60	14·60	18,700
May 13	C. E. Richardson	1,048	250	2,570	2·18	7·55	5,610
Aug. 26	J. A. Elliott	1,672	230	2,630	1·23	5·20	3,230

Monthly Discharge of Shuswap River, near Enderby for 1913.

(Drainage area, 1,650 square miles).

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April	5,660	603	2,712	1·64	1·83	161,000
May	14,300	4,150	7,258	4·40	5·07	446,000
June	21,800	13,400	17,443	10·57	11·80	1,040,000
July	13,600	5,380	9,106	5·52	6·36	560,000
August	5,240	2,810	3,789	2·29	2·64	233,000
September	3,160	2,180	2,773	1·68	1·87	165,000
October	2,080	1,720	1,957	1·18	1·36	120,000
November	1,980	1,560	1,746	1·06	1·18	104,000
December	1,560	965	1,240	0·75	0·86	76,200

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Daily Gauge Heights and Discharges of Shuswap River near Enderby for 1913.

Day.	April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·9	603	6·6	5,100	12·9	15,200
2	1·9	603	6·4	4,820	13·4	16,100
3	1·9	603	6·3	4,680	13·9	17,000
4	1·9	603	6·1	4,410	14·2	17,600
5	2·0	650	6·0	4,280	14·6	18,300
6	2·2	749	5·9	4,150	14·6	18,300
7	2·3	801	5·9	4,150	14·7	18,500
8	2·3	801	5·9	4,150	14·9	18,900
9	2·4	855	6·3	4,680	15·1	19,300
10	2·5	910	6·7	5,240	15·4	19,900
11	2·9	1,140	6·9	3,520	15·7	20,500
12	3·3	1,410	7·2	5,940	15·9	20,900
13	3·7	1,720	7·4	6,130	16·1	21,300
14	4·1	2,080	7·7	6,660	16·3	21,800
15	4·2	2,180	7·8	6,800	15·9	20,900
16	4·3	2,280	8·0	7,100	15·6	20,300
17	4·7	2,700	8·0	7,100	15·2	19,500
18	5·0	3,040	8·1	7,250	14·6	18,300
19	5·3	3,400	8·1	7,250	14·0	17,200
20	5·6	3,760	8·1	7,250	13·8	16,800
21	5·9	4,150	8·2	7,390	13·5	16,300
22	6·2	4,540	8·4	7,690	13·3	15,900
23	6·2	4,540	8·6	7,990	13·1	15,600
24	6·3	4,680	8·7	8,140	12·8	15,000
25	6·6	5,100	9·2	8,930	12·6	14,700
26	7·0	5,660	9·7	9,720	12·4	14,300
27	7·0	5,660	10·2	10,500	12·3	14,100
28	6·9	5,520	10·8	11,600	12·1	13,800
29	6·8	5,380	11·4	12,600	12·0	13,600
30	6·7	5,240	11·9	13,400	11·9	13,400
31	.....	.....	12·1	14,300	.....	.....

DAILY GAUGE HEIGHTS AND DISCHARGES of Shuswap River, near Enderby for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	12·0	13,600	6·7	5,240	4·7	2,700	4·1	2,080	4·0	1,980	3·5	1,560
2	11·9	13,400	6·5	4,960	4·6	2,590	4·1	2,080	4·0	1,980	3·5	1,560
3	11·7	13,100	6·4	4,820	4·7	2,700	4·0	1,980	4·0	1,980	3·4	1,480
4	11·4	12,600	6·2	4,540	5·0	3,040	4·0	1,980	3·9	1,890	3·4	1,480
5	11·1	12,000	6·1	4,416	5·1	3,160	4·0	1,980	4·0	1,980	3·4	1,480
6	10·7	11,400	6·0	4,280	5·1	3,160	3·9	1,890	4·0	1,980	3·3	1,410
7	10·7	11,400	5·9	4,150	5·1	3,160	3·8	1,800	4·0	1,980	3·3	1,410
8	10·4	10,900	5·9	4,150	5·1	3,160	3·8	1,800	4·0	1,980	3·3	1,410
9	10·2	10,500	5·8	4,020	5·1	3,160	3·8	1,800	3·9	1,890	3·2	1,340
10	10·0	10,200	5·8	4,020	5·1	3,160	3·7	1,720	3·9	1,890	3·2	1,340
11	9·9	10,000	5·7	3,890	5·1	3,160	3·8	1,800	3·9	1,890	3·2	1,340
12	9·7	9,720	5·6	3,760	5·1	3,160	3·8	1,800	3·9	1,890	3·1	1,270
13	9·6	9,560	5·6	3,760	5·1	3,160	3·8	1,800	3·9	1,890	3·1	1,270
14	9·5	9,400	5·6	3,760	5·0	3,040	4·0	1,980	3·8	1,800	3·1	1,270
15	9·6	9,560	5·6	3,760	4·9	2,920	4·0	1,980	3·8	1,800	3·0	1,210
16	9·4	9,240	5·6	3,760	4·9	2,920	4·0	1,980	3·8	1,800	3·0	1,210
17	9·2	8,930	5·5	3,640	4·8	2,810	4·0	1,980	3·7	1,720	3·0	1,210
18	9·0	8,620	5·6	3,760	4·7	2,700	4·0	1,980	3·7	1,720	3·0	1,210
19	8·8	8,300	5·6	3,760	4·7	2,700	4·0	1,980	3·7	1,720	3·0	1,210
20	8·5	7,840	5·6	3,760	4·7	2,700	4·0	1,980	3·6	1,640	2·9	1,140
21	8·4	7,690	5·5	3,640	4·6	2,590	4·1	2,080	3·6	1,640	2·9	1,140
22	8·2	7,390	5·4	3,520	4·6	2,590	4·0	1,980	3·6	1,640	2·9	1,140
23	8·1	7,250	5·4	3,520	4·6	2,590	4·0	1,980	3·6	1,640	2·9	1,140
24	7·9	6,950	5·3	3,400	4·5	2,480	4·0	1,980	3·6	1,540	2·8	1,080
25	7·8	6,800	5·2	3,280	4·4	2,380	4·1	2,080	3·6	1,640	2·8	1,080
26	7·6	6,520	5·1	3,160	4·4	2,380	4·1	2,080	3·6	1,640	2·8	1,080
27	7·4	6,130	5·1	3,160	4·3	2,280	4·1	2,080	3·5	1,560	2·8	1,080
28	7·3	6,080	5·0	3,040	4·3	2,280	4·1	2,080	3·5	1,560	2·7	1,020
29	7·2	5,940	4·9	2,920	4·2	2,180	4·0	1,980	3·5	1,560	2·7	1,020
30	7·1	5,800	4·8	2,810	4·2	2,180	4·0	1,980	3·5	1,560	2·6	965
31	6·8	5,380	4·8	2,810	.....	.....	4·0	1,980	.....	.....	2·6	965

SHUSWAP RIVER AT COTEAU FALLS.

Location.—At Highway bridge crossing below Coteau Falls near Lumby, B.C.

Records Available.—Complete records have been taken by Coteau Power Company and C. N. R. engineers during 1912 and 1913. Through their courtesy these records for 1913 have been made available.

Gauge.—Vertical staff gauge with standard enamel facings. Gauge readings obtained daily by R. H. Spurling, C.E.

Channel.—Varying in width from 70 feet at low water to 150 feet at high water. The jamming of logs on a gravel bar below the gauge is a cause of possible backwater.

Discharge Measurements.—The company's engineer obtains a metering at every appreciable change of stage. A check measurement on his results by British Columbia Hydrographic engineers showed a discrepancy of 6 per cent.

Accuracy.—Further check measurements will be made during 1914, Accuracy is probably very high since obviously great care is taken in obtaining results.

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Monthly Discharge of Shuswap River near Coteau Falls for 1913.

(Drainage area, 640 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	530	336	382	·60	·69	23,488
February	478	382	412	·64	·67	22,881
March	417	371	388	·61	·70	23,857
April	2,730	374	1,405	2·20	2·45	83,600
May	9,200	1,605	3,925	6·13	7·07	241,340
June	13,276	6,280	8,778	13·72	15·31	523,330
July	6,150	2,600	4,288	6·70	7·72	263,660
August	23,74	1,470	2,070	3·23	3·72	127,280
September	25,28	1,079	1,528	2·39	2·67	90,920
October	1,350	900	1,139	1·78	2·05	70,040
November	1,160	728	887	1·39	1·55	52,780
December	710	455	541	·85	·98	33,265
The year	13,276	336	2,145	3·36	45·58	1,555,41

Daily Gauge Heights and Discharges of Shuswap River near Coteau Falls for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1		530		345		417		374		1,870		9,400
2		530		382		417		374		1,805		10,198
3		487		438		417		374		1,710		10,400
4		455		418		417		374		1,675		11,700
5		413		393		395		384		1,605		10,570
6		395		383		395		425		1,620		9,840
7		435		383		395		412		1,610		9,310
8		482		383		395		412		1,705		9,650
9		455		383		395		420		1,975		11,780
10		382		383		405		463		2,595		13,275
11		336		383		413		563		2,975		13,276
12		337		383		382		757		3,330		12,475
13		340		383		376		1,065		3,983		10,945
14		340		395		372		1,247		4,020		10,678
15		340		417		375		1,440		3,930		9,335
16		343		435		376		1,475		3,720		8,160
17		351		476		395		1,670		3,590		6,913
18		355		455		407		1,880		3,440		6,334
19		343		455		388		2,160		3,330		6,300
20		340		455		378		2,320		3,400		6,788
21		351		393		373		2,550		3,440		7,460
22		355		478		376		2,730		3,753		7,310
23		355		455		376		2,595		4,020		6,595
24		355		435		378		2,458		4,760		6,430
25		352		417		376		2,430		5,475		6,430
26		352		417		376		2,315		6,000		6,430
27		352		406		378		2,280		6,375		6,280
28		352		395		373		2,220		7,790		6,360
29		348				371		2,024		8,320		6,356
30		345				371		1,957		8,660		6,356
31		345				374				9,200		

DAILY GAUGE HEIGHTS AND DISCHARGES of Shuswap River near Coteau Falls, for 1913.—*Continued.*

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	6,150	.....	2,374	.....	1,415	.....	1,050	.....	1,127	.....	710
2	.....	5,910	.....	2,310	.....	1,401	.....	1,040	.....	1,160	.....	688
3	.....	5,616	.....	2,270	.....	1,352	.....	999	.....	1,060	.....	651
4	.....	5,460	.....	2,310	.....	1,800	.....	960	.....	1,023	.....	545
5	.....	5,108	.....	2,310	.....	2,200	.....	960	.....	1,050	.....	640
6	.....	4,770	.....	2,310	.....	2,528	.....	945	.....	1,050	.....	625
7	.....	5,114	.....	2,270	.....	2,380	.....	930	.....	1,042	.....	615
8	.....	5,400	.....	2,270	.....	2,200	.....	920	.....	1,034	.....	600
9	.....	5,204	.....	2,506	.....	1,958	.....	920	.....	1,020	.....	580
10	.....	5,100	.....	2,520	.....	1,860	.....	900	.....	1,020	.....	565
11	.....	4,950	.....	2,250	.....	1,730	.....	920	.....	990	.....	548
12	.....	4,566	.....	2,210	.....	1,530	.....	1,010	.....	940	.....	548
13	.....	4,456	.....	2,210	.....	1,539	.....	1,165	.....	873	.....	548
14	.....	4,340	.....	2,190	.....	1,475	.....	1,280	.....	840	.....	548
15	.....	4,250	.....	2,190	.....	1,420	.....	1,290	.....	825	.....	548
16	.....	4,020	.....	2,130	.....	1,350	.....	1,300	.....	840	.....	540
17	.....	3,910	.....	2,030	.....	1,287	.....	1,280	.....	825	.....	530
18	.....	3,900	.....	2,067	.....	1,294	.....	1,225	.....	825	.....	530
19	.....	3,620	.....	2,130	.....	1,350	.....	1,225	.....	778	.....	505
20	.....	3,620	.....	2,090	.....	1,364	.....	1,240	.....	790	.....	478
21	.....	3,725	.....	2,067	.....	1,300	.....	1,240	.....	776	.....	475
22	.....	3,900	.....	1,990	.....	1,420	.....	1,200	.....	776	.....	475
23	.....	3,900	.....	1,900	.....	1,360	.....	1,200	.....	755	.....	475
24	.....	3,900	.....	1,812	.....	1,310	.....	730	.....	730	.....	470
25	.....	3,750	.....	1,812	.....	1,265	.....	1,330	.....	740	.....	460
26	.....	3,600	.....	1,750	.....	1,230	.....	1,350	.....	740	.....	465
27	.....	3,410	.....	1,675	.....	1,167	.....	1,287	.....	765	.....	465
28	.....	3,020	.....	1,670	.....	1,150	.....	1,273	.....	755	.....	465
29	.....	2,850	.....	1,548	.....	1,130	.....	1,250	.....	728	.....	465
30	.....	2,820	.....	2,530	.....	1,079	.....	1,148	.....	740	.....	455
31	.....	2,600	.....	1,470	.....	.....	.....	1,140	.....	.....	.....	465

SCOTTIE CREEK.

Location.—Section 16, township 23, range 25, west 6th meridian, north of Ashcroft, B.C., and tributary to the Bonaparte river.

Records Available.—June 1 to October 31, 1911; April 1 to September 8, 1912; May 1 to November 28, 1913.

Winter Conditions.—Conditions throughout the winter are similar to those obtained at Ashcroft. There is however, a slightly higher snowfall. Under ordinary circumstances the stream freezes up during the winter months.

Gauge.—Standard vertical staff gauge installed above diversions. Readings made daily during the irrigation season by A. G. Hunter.

Channel.—At measuring section the water is sluggish owing to effect of dam below. The gauge is above all influence of backwater. The stream is 15 to 20 feet in width and the control is good.

Discharge Measurements.—The gauge-height-discharge curve is fairly well defined, but during the freshet the necessity for a stilling box at the gauge was felt.

Accuracy.—Accuracy of returns shown is only fair.

SCOTTIE CREEK.

Scottie creek has its source in the Arrowhead hills, at an elevation of 5,000 feet, and discharges into the Bonaparte river from the east, near 19 mile post on the Cariboo road, at an elevation of 1,600 feet. It is part of the Thompson-Fraser drainage. Its drainage area above the mouth is 73 square miles. and the gauging station is near the mouth. The water is used for irrigation, and the supply is usually insufficient. Water from Scottie creek was used for placer mining at one time.

The drainage basin of Scottie creek is very rough, with no agricultural land. There are canyons on the stream in places, and the fall is quite heavy. There is a wagon road for only half a mile up the creek, with a pack trail for several miles farther. There was a placer mine in the valley at one time, but it has been abandoned. There are indications of mineral in the vicinity. There is some timber in the valley, but it is mostly small and its main use would be to conserve the moisture and prevent erosion. Most of the land in the watershed will be used for nothing but grazing.

At one of the canyons a storage dam might be constructed to store surplus flood waters for use in the latter part of the irrigation season. The canyon is said to be 30 feet deep and 20 feet wide with a good basin behind it.

Scotttie creek is in the dry belt. The precipitation is from 8 to 10 inches The weather is hot in summer and cold in winter.

The gauge on Scottie creek is near the mouth, just above Walker's diversion. Since the station was established Hunter has dug a ditch above it, and was diverting water through it during part of July and August, 1912. The station was established on June 6, 1911, and the gauge readings were taken twice a day during the irrigation seasons of 1911 and 1912 and 1913. The gauge is a 5-foot cedar staff securely nailed to a tree stump on the left bank of the creek about 200 feet above Walker's diversion, and just behind Hunter's stable. The meter measurements are made by wading at a section 50 feet below the gauge. The stream above the section is rapid, and below the section it is backed up by the diversion dam. The banks are high enough to prevent overflowing, and are covered with bushes. The bed of the stream is rocky in the rapids with a deposit of mud in the quieter water at the dam. The influence of the dam does not extend to the gauge. It is hard to read the gauge accurately at high water. The general level of the water near the gauge should be taken, not the point to which the water backs up. The bank is undercut at the gauge, but it does not seem to effect the accuracy.

DISCHARGE MEASUREMENTS of Scotttie Creek, above Walker's Diversion, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Apr. 30	Chisholm & Cline	1,055	17	10·50	1·3	0·95	14
May 24	K. G. Chisholm	1,055	18	15·45	1·64	1·27	25
May 26	do	1,055	18	14·05	1·77	1·27	25
Aug. 1	do	1,055	15	6·94	1·13	0·81	7·9

Monthly Discharge of Scottie Creek above Walker's Diversion for 1913.

(Drainage area, 73 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre feet.
May	41·5	13·0	22·8	·31	·36	1,402
June	22·5	9·5	12·6	·17	·19	750
July	28·8	10·2	15·3	·21	·24	941
August	16·2	7·1	9·7	·13	·15	596
September	10·2	7·1	7·7	·10	·12	458
October	10·2	8·1	8·4	·11	·13	516
November	9·0	7·1	7·2	·10	·11	428
The period	138·4	62·1	12·0	·16	1·30	5,091

Daily Gauge Heights and Discharges of Scottie Creek above Walker's Diversion for 1913.

Day.	April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			1·0	14·7	1·07	15·9
2			0·95	13·0	1·07	15·9
3			0·95	13	1·02	15·3
4			0·97	13·7	·95	13
5			0·97	13·7	·95	13
6			1·0	14·7	·92	12·1
7			1·0	14·7	·9	11·5
8			1·02	15·3	·9	11·5
9			1·35	25·6	·9	11·5
10			1·85	41·5	·9	11·5
11			1·65	35·1	·87	10·7
12			1·65	35·1	·85	10·2
13			1·65	35·1	·85	10·2
14			1·65	35·1	·85	10·2
15			1·45	28·8	·85	10·2
16			1·35	25·6	·82	9·5
17			1·35	25·6	·82	9·5
18			1·35	25·6	·82	9·5
19			1·35	25·6	·82	9·5
20			1·3	24·1	·82	9·5
21			1·3	24·1	·82	9·5
22			1·3	24·1	·82	9·5
23			1·25	22·5	·82	9·5
24			1·25	22·5	·82	9·5
25			1·25	22·5	·87	10·7
26			1·22	21·5	1·05	16·2
27			1·22	21·5	1·15	19·4
28			1·2	20·9	1·1	17·8
29			1·15	19·3	1·25	22·5
30			1·10	17·8	1·25	22·5
31	1·00	.....	1·07	15·9	.....	.....

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DAILY GAUGE HEIGHTS AND DISCHARGES of Scottie Creek above Walker's Diversion for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·10	17·8	·82	9·5	·7	7·1	75	8·1	·75	8·1
2	1·02	15·3	·82	9·5	·7	7·1	75	8·1	·75	8·1
3	1·02	15·3	·82	9·5	·7	7·1	77	8·4	·65	6·2
4	1·02	15·3	·8	9·0	·7	7·1	75	8·1	·65	6·2
5	1·0	14·6	·75	8·1	·7	7·1	75	8·1	·7	7·1
6	·95	13·0	·75	8·1	·7	7·1	75	8·1	·75	8·1
7	·95	13·0	·75	8·1	·7	7·1	75	8·1	·85	10·2
8	·95	13·0	·75	8·1	·7	7·1	75	8·1	·85	10·2
9	·92	12·1	·75	8·1	·7	7·1	75	8·1	·75	8·1
10	·9	11·5	75	8·1	·7	7·1	75	8·1	·75	8·1
11	·85	10·2	·75	8·1	·7	7·1	75	8·1	·65	5·7
12	·9	11·5	·75	8·1	·7	7·1	80	9·0	·55	4·7
13	1·05	16·2	·85	10·2	·7	7·1	·80	9·0	·55	4·7
14	1·35	25·6	·85	10·2	·7	7·1	·77	8·4	·55	4·7
15	1·35	25·6	·82	9·5	·7	7·1	·75	8·1	·75	8·1
16	1·45	28·8	·80	9·0	·7	7·1	·75	8·1	·75	8·1
17	1·27	23·1	·85	10·2	·7	7·1	·75	8·1	·75	8·1
18	1·27	23·1	·95	13·0	·7	7·1	·8	9·0	·55	4·7
19	1·25	22·5	1·1	17·8	·7	7·1	·8	9·0	·75	8·1
20	1·2	20·9	1·05	16·2	·7	7·1	·8	9·0	·55	4·7
21	1·05	16·2	·97	13·7	·75	8·1	·75	8·1	·75	8·1
22	·95	13·6	·90	11·5	·85	10·2	·75	8·1	·65	6·2
23	·92	12·1	·90	11·5	·85	10·2	·75	8·1	·55	4·7
24	·92	12·1	·85	10·2	·82	9·5	·75	8·1	·75	8·1
25	·85	10·2	·82	9·5	·80	9·0	·75	8·1	·75	8·1
26	·85	10·2	·75	8·1	·77	8·4	·85	10·2	·75	8·1
27	·85	10·2	·75	8·1	·75	8·1	·85	10·2	·8	9·0
28	·85	10·2	·75	8·1	·75	8·1	·75	8·1	.....	.....
29	·85	10·2	·72	7·5	·75	8·1	·75	8·1	.....	.....
30	·85	10·2	·7	7·1	·75	8·1	·75	8·1	.....	.....
31	·85	10·2	·7	7·1	.....	.....	·75	8·1	.....	.....

SPIUS CREEK.

Location.—Section 15, township 13, range 23, west 6th meridian.

Records Available.—August 18 to November 22, 1911; May 8 to September 12, 1912; May 25 to November 30, 1913.

Winter Conditions.—Ice conditions exist from November to February under normal conditions. There are several cold periods usually of short duration.

Gauge.—Chain gauge established on March 18, 1914, to replace staff gauges which gave unsatisfactory results. The gauge height is read daily by George A. Longbottom.

Channel.—The channel is of rocks and boulders and the velocity of the current is high, even at low water.

Discharge Measurements.—Numerous meterings have been obtained, but it will be necessary to have the new gauge completely rated during 1914.

Accuracy.—The accuracy of results obtained from discharge curves during the past three years is low, and only slight dependence may be placed on them.

SPIUS CREEK.

Spius creek has its source in mountains near township 11, range 23, west 6th meridian, at an elevation of 4,000 feet and flowing due north for 25 miles, discharges into Nicola river, near the Railway Belt boundary, at an elevation of 1,800 feet. It is part of the Nicola-Thompson drainage; the drainage area, as measured from a Dominion sectional map, scale 3 miles to an inch, is 344 square

miles. The stream is used for both lumbering and irrigation. It is a stream varying from 25 to 100 feet in width, from 2 to 10 feet in depth, and with a mean velocity of from 1.5 to 5 feet per second. There is a very large freshet in May. The bed of the stream is generally rocky, and at times it passes through canyons and over small falls. The valley of the creek varies from one-fourth of a mile to 1 mile in width, and contains good agricultural land, for which irrigation is necessary, the precipitation not exceeding 20 inches, excepting very near the source. Considerable land is also taken up along Prospect creek, a large tributary entering from the west, about 10 miles from the mouth. Several timber limits are held along Spius creek about 5 miles from the mouth, by the Nicola Valley Pine Lumber Company. This company established a mill 1 mile up the creek; constructing a timber, rock filled dam, 40 feet high, which affords them a log pond of 25 acres. Logs are driven down the creek during the freshet in May and June.

The first station was established on August 15, 1911, by C. E. Richardson. This station was abandoned at the end of the 1911 season on account of a dam put in by the Nicola Valley Pine Lumber Company, causing back water, and a new gauge put in below the dams by C. E. Richardson on May 22, 1912. On June 22, C. G. Cline moved this gauge up-stream because of interference from irrigation ditchhead works. B. Corbould put in another new gauge in August 14, 1912, which was carried away by a freshet on November 9. Mr. Keys put in a new staff gauge on May 26, 1913, which was again carried away by a freshet. Mr. Keys then established a chain gauge at Longbottom's ranch, 2 miles from the stream's mouth in August, 1913. This was found to be unreliable, so it was replaced by a new chain gauge installed by Mr. Chisholm, on March 18, 1914.

Discharge Measurements of Spius Creek at Longbottom's Ranch, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Aug. 1	H. J. E. Keys	1,057	72	85	1·6	6·0	132
" 21	do	1,057	80	44	2·1	5·8	[1]94·6

Note.—[1] Different section.

Monthly Discharge of Spius Creek, near Canford, for 1913.

(Drainage area, 344 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
June	535	40	171	0·50	0·56	10,200
July	265	43	131	0·38	0·44	8,050
August	564	123	200	0·58	0·65	11,900
September	304	123	192	0·55	0·63	11,800
October	218	132	162	0·46	0·51	9,640

Note.—Accuracy "D".
A gauge was established below dam in same position as former gauge in May. But pier to which gauge was fastened was torn out. Finally a chain gauge was established about 2 miles above dam on August 1. This gauge was found unsatisfactory and was replaced by a new chain gauge on March 18, 1914.

Spius Creek—Metering Station.

DAILY GAUGE HEIGHTS AND DISCHARGES of Spius Creek, near Canford, for 1913.

DAY.	May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	3·0	535
2	.....	.....	3·0	535
3	.....	.....	3·0	535
4	.....	.....	3·0	535
5	.....	.....	2·25	200
6	.....	.....	2·25	200
7	.....	.....	2·25	200
8	.....	.....	2·25	200
9	.....	.....	2·5	290
10	.....	.....	2·25	200
11	.....	.....	2·05	142
12	.....	.....	2·25	200
13	.....	.....	2·3	215
14	.....	.....	2·0	130
15	.....	.....	1·55	65
16	.....	.....	1·5	60
17	.....	.....	1·4	50
18	.....	.....	1·4	50
19	.....	.....	1·75	88
20	.....	.....	1·8	95
21	.....	.....	1·6	70
22	.....	.....	1·6	70
23	.....	.....	1·6	70
24	.....	.....	1·7	80
25	2·35	232	1·7	80
26	2·5	290	1·4	50
27	3·0	535	1·3	40
28	3·0	535	1·35	45
29	2·5	290	.....	45
30	2·75	405	.....	45
31	2·7	380	.....	.....

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DAILY GAUGE HEIGHTS AND DISCHARGES of Spius Creek, near Canford, for 1913—*Continued.*

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			6·0	132	6·0	132	6·0	132	6·1	150		
2				132	5·95	123	6·0	132	6·05	141		
3				132	6·1	150	5·95	123	6·0	132		
4			6·0	132	8·17	564	5·95	123	6·0	132		
5			6·0	132	7·5	425	5·95	123	6·0	132		
6			6·0	132	6·8	284	6·0	132	6·1	150		
7			6·0	132	6·65	256	6·0	132	6·15	159		
8			6·05	141	6·65	237	6·05	141	6·2	168		
9			6·0	132	6·55	237	6·1	150	6·2	168		
10			5·5	43	6·45	218	6·6	246	6·2	168		
11			5·5	43	6·4	208	6·7	265	6·2	168		
12			6·7	265	6·35	198	6·9	304	6·2	168		
13			6·5	227	6·35	198	6·9	304	6·2	168		
14			6·0	132	6·35	198	6·6	246	6·15	159		
15			5·7	78	6·3	188	6·5	227	ice.	189		
16			5·7	78	6·25	178	6·5	227	6·45	218		
17			6·05	141	6·25	178	6·4	208	6·35	198		
18			6·17	163	6·25	178	6·4	208	6·25	168		
19			6·15	159	6·2	168	6·4	208	6·2	168		
20			6·1	150	6·15	159	6·4	208	6·2	168		
21			6·05	141	6·15	159	6·4	208	6·15	159		
22			6·05	141	6·15	159	6·4	208	6·1	150		
23			6·0	132	6·15	159	6·45	218	6·1	150		
24			6·0	132	6·15	159	6·45	218	6·15	159		
25			6·0	132	6·15	159	3·4	208	6·2	168		
26			6·0	132	6·1	150	6·35	198	6·15	159		
27			5·95	123	6·1	150	6·3	188	6·15	159		
28			5·9	113	6·1	150	6·25	178	6·15	159		
29			5·9	113	6·05	141	6·2	168	6·15	159		
30			5·9	113	6·0	132	6·2	168	6·15	159		
31			5·95	123			6·15	159				

STEIN CREEK.

Location.—At highway bridge, near mouth, in section 27, township 15, range 27, west of 6th meridian,

Records Available.—September 22 to December 23, 1911; January 14 to November 24, 1912; April 11 to August 31, 1913.

Winter Conditions.—Open water at gauge all year.

Gauge.—Vertical staff gauge. Also auxiliary chain gauge on bridge. Gauge readings about once a week.

Channel.—Rocks and Boulders—eddies at certain stages.

Discharge Measurements.—One measurement in 1911, three in 1912, and one in 1913 show fair agreement but do not cover the bigger freshets.

Accuracy.—The infrequency of the gauge readings impairs the reliability of the records.

STEIN CREEK.

Stein creek has its source in the mountains surrounding Mountain Stein, at an elevation of 5,000 feet, and flowing in an easterly direction for a distance of 30 miles, discharges into the Fraser river near Lytton at an elevation of 500 feet. It is part of the Fraser drainage; the drainage area, as measured from a Dominion sectional map, scale 3 miles to 1 inch, is 130 square miles.

The precipitation at the mouth is small, not exceeding 20 inches, but at the source on the eastern mountains of the Coast range, the precipitation, both rain and snow, is heavy, from 50 to 70 inches.

The maximum discharge in 1912 amounted to 3,000 second-feet on June 30; the minimum flow was 80 second-feet on the 10th of March. The stream is generally about 50 feet wide, from 2 to 10 feet deep, and varying in velocity from 1.5 to 8 feet per second. The valley is rough and broken, covered with underbrush and scattered timber. The stream is swift and turbulent, rushing in and out of canyons, and over rapids and falls. The drop in the last 20 miles of the river is at the rate of 150 feet per mile.

Through this district the hunting is excellent, and the fishing unexcelled. Stein creek was prospected years ago, and a trail still runs practically to the source, but it presents great difficulties to travellers.

Stein creek is used at the present time for irrigation purposes. Records to the extent of 1,000 inches have been taken out, appurtenant to lands in the vicinity along the valley of the Fraser.

The C.P.R. investigated Stein creek regarding water-power possibilities. The chief objection to any power development on Stein creek is the lack of storage. Good summer power may be obtained.

The hydrographic station on Stein creek was established on September 22, 1913, by C. E. Richardson. The measuring section is located on the downstream side of the highway bridge, about half a mile from the mouth, and 3 miles from the Fraser river ferry above Lytton. All measurements are made by suspending the meter from a cable. A standard vertical staff gauge is fastened to the cribbing of the right abutment, on the downstream side. In the spring of 1912 a chain gauge was established, for use during high water; the datum of both gauges is the same, and is referred to three bench-marks.

DISCHARGE MEASUREMENTS of Stein Creek near Mouth, 1911, 1912 and 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
ept. 22.....	C. E. Richardson.....	1,048	57	203	3·4	0·60	685
1912.							
March 27.....	C. G. Cline.....	1,046	38	121	1·3	−1·00	[1]152
May 30.....	C. G. C. & B. C.....	1,046	55	279	4·9	1·75	1,360
July 26.....	C. G. Cline.....	1,046	50	250	4·8	1·70	1,190
1913.							
Sept. 6.....	C. G. C. & K. G. C.....	1,055	50	251	4·8	1·55	1,195

NOTE.—[1] Below zero of gauge.

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Monthly Discharge of Stein creek near Mouth for 1913.

(Drainage area, 130 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April	690	500	585	4·5	5·02	34,800
May	2,970	630	1,659	12·7	14·6	102,030
June	4,800	1,890	2,817	21·6	24·1	167,000
July	2,110	1,480	1,791	13·8	15·9	110,000
August	1,660	790	1,251	9·6	11·1	76,900

Daily Gauge Heights and Discharges of Stein creek near Mouth for 1913.

Day.	April.		May.		June.		July.		August	
	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1		500		630		3,200		2,020	2·3	1,660
2		500		640		3,500		2,030		1,630
3		500	0·5	640		3,800	2·9	2,040		1,600
4		500		700		4,200		2,060		1,570
5		500		760		4,500		2,080		1,540
6		500		820	7·0	4,800	3·0	2,110		1,500
7		500		880		4,500		2,080		1,480
8		500		940		4,200		2,040		1,450
9		500		1,000		3,900		2,040	1·9	1,420
10		500		1,060		3,500		2,020		1,380
11	0·30	550	1·4	1,120		3,200		2,000		1,340
12		560		1,210		2,800	2·8	1,980		1,310
13		580		1,300		2,600	2·8	1,980		1,280
14		600		1,390		2,300		1,900		1,250
15		620		1,480	2·8	1,980		1,830		1,220
16		640		1,570		2,040		1,760	1·5	1,180
17		660	2·3	1,660		2,090		1,690		1,200
18		670		1,760		2,140		1,620		1,220
19		680		1,860		2,190		1,550	1·6	1,240
20	0·60	690		1,960	3·2	2,240	2·0	1,480		1,200
21		670		2,060		2,210		1,500		1,170
22		660		2,160		2,170		1,510		1,140
23		650		2,270		2,130		1,520		1,100
24		640	3·4	2,370		2,100		1,540	1·3	1,070
25	0·45	620		2,470		2,070		1,550		1,100
26	0·45	620		2,570		2,040		1,560	1·4	1,120
27	0·40	600		2,670	2·8	1,980		1,570		1,030
28		600	4·0	2,760		2,000		1,580		940
29		610		2,830	2·85	2,010	2·2	1,600	0·9	840
30		620		2,900		2,020		1,620		820
31			4·3	2,970				1,640	0·8	790

THOMPSON RIVER AT SPENCES BRIDGE.

Location.—Section 2, township 17, range 25, west 6th meridian.

Records Available.—October 25 to December 31, 1911; January 1 to December 31, 1912; January 1 to December 31, 1913.

Winter Conditions.—There are some short cold periods as a rule, but the river usually remains open throughout the year.

Gauge.—The gauge is a chain gauge with graduations marked on bridge rail. Daily readings are made by Miss Violet Curnow.

Channel.—The channel varies from 400 to a little over 500 feet in width, the flow ranging from 4,000 second-feet at low water to 110,000 second-feet at high stages. At high water the stream is 16 feet deeper than at low, while mean velocities range from 2 feet per second to 11 feet per second.

Discharge Measurements.—Measurements are made by cable suspension from the upstream side of traffic bridge spanning the river at the town of Spences Bridge. Owing to the extremely high velocities at high stages meterings are very difficult to obtain. However, the discharge-gauge-height curve is well defined.

Accuracy.—Results for 1913 bear a high degree of accuracy and are considered to be within 5 per cent of the truth.

Thompson River at Spences Bridge. (Metering Station.)

Thompson river from Kamloops to Lytton is 74 square miles.

(1) The North Thompson river rises at an elevation of 4,000 to 6,000 feet, about 10 miles south of Tête Jaune Cache. It might be noted here that within a radius of 5 miles may be found the source of the Fraser, the Canoe (a large tributary of the Columbia river) and the North Thompson river, the three streams which drain practically the whole of British Columbia. From its source, the North Thompson river flows south to Kamloops, where it joins the South Thompson river. The valley of the North Thompson is being opened up by the Canadian Northern Pacific railway, which runs beside the river from Tête Jaune Cache to Kamloops.

The mineral wealth of the country in this drainage is still unknown. Mica exists in large quantities in the upper valley above Mad river. Gold has been found in various tributaries, and at present a mine is being worked at Louis creek, about 30 miles from Kamloops, which, if it turns out well, will be a big asset to the surrounding country. Water-power may be developed on the river

itself at Hells Gate, 160 miles up. A head of 30 feet may be obtained, and a minimum flow of 300 to 500 second-feet. Of the tributaries, the Barrier river, at the 35-mile post, is the most important. A plant is now being installed whereby the city of Kamloops will obtain its light and power from the Barrier. Good industrial powers of 1,000 to 2,000 horse-power, may be located on the following streams: Mad river, at the 97-mile post; Tum Tum creek, at the 112-mile post; Salmon or Porcupine creek, at the 136-mile post; Hell Roaring creek, at the 152-mile post; Pyramid creek, at the 162-mile post, Clearwater river 70 miles from Kamloops.

From Tête Jaune Cache to Kamloops by the river is about 250 miles, but by the C.N.R. it is less than 190. (All mile-posts are located by the C.N.R.) From Kamloops to Mad River, at the 97-mile post the valley varies from half a mile to 1 mile in width. The soil is a sandy loam, and first-class land for fruit and mixed farming. Above Mad River the valley becomes much narrower, and there are only about 16,000 acres of arable land. Irrigation is required up to the 100-mile post, the precipitation varying from 7 inches at Kamloops to 40 inches at the Albreda Summit. Practically all the land has been taken up in the valley. There is very little large timber in the valley, except near the source, where several limits are held.

The streams and rivers above the 97-mile post are devoid of fish, said to be due to the large amount of mica in the waters, and apart from a few bears, there is no game to speak of in the valley.

The gauging station on the North Thompson river is 18 miles from the mouth. Here the river is 500 feet wide, and the depth varies from 6 feet to 25 feet, The rise and fall of the river at this point is about 15 feet. The maximum discharge in 1912 was 50,000 second-feet in May. The minimum flow was 2,050 second-feet in March. Maximum for 1913 was 65,000 in June, minimum 33,000 in April.

The North Thompson river is navigable during the summer from Kamloops to the 92-mile post, from the 112-mile post to 125-mile post, and from 137 to 172 mile.

(2) As before stated, the North and South Thompson meet at Kamloops. Strictly speaking, the Thompson river rises in the Shuswap lakes, and is only a flowing stream between Chase and Kamloops, a distance of 40 miles. And it is a very slow flowing stream. The drop between the Shuswap lakes and Kamloops being only 15 feet. The valley between Kamloops and Chase is from 1 mile to 3 miles wide, and is very suitable for mixed farming and fruit growing.

The drainage is 400 square miles, and a large percentage of this land may be cultivated or used for grazing purposes. The one great drawback is the lack of water for irrigation.

The remaining 7,000 square miles of the South Thompson drainage are drained by the Shuswap lakes. The chief feeders of this body of water are the Adams river, Anstey river, Seymour river, Eagle river, Shuswap river, and Salmon river. The precipitation throughout the drainage of these streams averages about 30 inches, the Salmon river being the only one in the dry belt. The Adams river is an ideal power stream, and also drains a fertile and well-timbered country. The Shuswap river has two good power sites on it, one below Sugar lake and the other below Mabel lake. Immense timber limits are held around Mabel and Sugar lakes. The Shuswap river drains the famous Okanagan valley from Armstrong north. The Salmon river drains the Grand Prairie district so well known as a mixed farming and ranching country. For further information on these streams see the individual gazetteers and reports.

The gauging station on this river was installed at Chase, B.C., in 1911. The width of the stream at the section is 400 feet, the depth from 15 feet to 25 feet

The maximum flow during the two years was 36,000 c. f. s., and took place on March 1, 1912. The rise and fall of the river at this section is 10 feet.

The South Thompson is navigable during the summer. Steamers ply between Chase, Sicamous, Salmon Arm, Anstey Arm, and Seymour Arm.

(3) From Kamloops the river flows into Kamloops lake, which is about 20 miles long and from 1 mile to 2 miles wide. As the river leaves the lake the fall becomes greater, and in the 20 miles to Ashcroft there is a drop of 200 feet. After leaving Ashcroft the river flows through the Black canyon. Between Ashcroft and Spences Bridge the river is very swift, and in the 25 miles there is a fall of 225 feet. Between Spences Bridge and Lytton the river is in a canyon practically all the way (30 miles). The fall in this distance is 317 feet. At Lytton the Thompson river discharges into the Fraser river. The Canadian Pacific Railway follows the left bank of the river from Kamloops, also from Chase to Lytton. The Canadian Northern Railway comes down the North Thompson and then follows the right bank practically all the way to Lytton. This eliminates any power possibilities.

There are good bench lands on both sides of the Thompson between Kamloops and Spences Bridge. The Ashcroft district is famous for its potatoes. The other benches are practically the same soil, and equally as valuable. Lack of water is the great difficulty in cultivation all through this district. The precipitation is very small, not exceeding 10 inches.

The three largest tributaries of the Thompson river below Kamloops, are the Deadman, entering from the right, below Savona lake, the Bonaparte entering from the right at Ashcroft, and the Nicola entering from the left at Spences Bridge, all drain rich agricultural districts and ranching countries. Practically the whole drainage below Kamloops and above Spences Bridge consists of a rolling-hill country unexcelled for ranching, and rich agriculturally where water can be obtained.

There is gold in the Thompson river, iron is prevalent in the Kamloops district, and three coal mines are working at Merritt in the Nicola valley.

The gauging station was established at Spences Bridge in October 1911, and continuous daily readings have been taken since. The river at this section is 400 feet wide and from 8 feet to 20 feet deep. The water is very swift, and never freezes in the winter. The maximum flow in 1912 was 90,000 c. f. s., and the minimum was 5,000 c. f. s.

The Thompson river drains the most settled part of the interior of British Columbia, with the exception of the lower Okanagan valley. The climate generally might be described as hot and dry in the summer, a cold short winter, with little snow. The country is well supplied with game, and fishing is good in both large and small streams and lakes.

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Monthly Discharge of Thompson River at Spences Bridge for 1913.

(Drainage area, 21,000 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	6,620	5,075	5,730	0·27	0·31	352,320
February	5,870	5,000	5,454	0·26	0·27	302,900
March	5,330	4,925	5,152	0·25	0·29	316,800
April	23,200	5,240	11,749	0·56	0·62	699,100
May	73,600	23,200	42,460	2·02	2·33	2,610,700
June	110,420	78,000	95,976	4·57	5·10	5,711,000
July	86,800	52,070	64,703	3·08	3·56	3,978,000
August	50,000	35,400	42,270	2·01	2·32	2,599,000
September	34,800	22,740	29,205	1·39	1·55	1,737,500
October	22,280	14,820	17,013	0·81	0·93	1,045,900
November	14,400	9,950	11,811	0·56	0·62	702,600
December	9,390	5,750	4,355	0·21	0·23	267,780
Year	110,420	4,925	27,990	15·99	18·13	20,323,600

Discharge Measurements of Thompson River at Spences Bridge, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 8	K. G. Chisholm & C. G. Cline.	1,044	400	4,351	5·42	7·1	23,593
June 16	K. G. Chisholm	1,055	511	8,989	10·67	17·7	95,674
June 18	K. G. Chisholm & C. G. Cline.	1,044	503	9,229	10·83	18·15	99,970
Aug. 12	K. G. Chisholm	1,055	446	5,735	7·45	11·4	42,739

Daily Gauge Heights and Discharges of Thompson River at Spences Bridge for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·4	6,620	1·9	5,870	1·3	5,420	1·3	5,240	6·8	22,280	15·5	78,000
2	2·4	6,620	1·6	5,530	1·4	5,330	1·4	5,330	6·9	22,740	16·0	82,400
3	2·3	6,450	1·4	5,330	1·4	5,330	1·4	5,330	7·0	23,200	16·6	87,680
4	2·3	6,450	1·4	5,350	1·4	5,330	1·4	5,330	7·0	23,200	17·2	92,980
5	2·2	6,290	1·3	5,240	1·4	5,330	1·4	5,330	7·0	23,200	17·4	94,800
6	2·0	6,000	1·0	5,000	1·3	5,240	1·5	5,425	7·0	23,200	17·6	96,620
7	2·0	6,000	1·3	5,000	1·4	5,330	1·5	5,425	7·0	23,200	17·8	98,480
8	1·8	5,750	1·6	5,530	1·4	5,330	1·5	5,425	7·1	23,660	17·8	98,480
9	1·6	5·550	1·7	5,640	1·3	5,240	1·6	5,530	7·5	25,500	17·8	98,460
10	1·4	5,330	1·8	5,750	1·4	5,330	1·6	5,530	8·0	27,800	18·1	101,220
11	1·1	5,075	1·7	5,640	1·4	5,330	1·6	5,530	8·4	29,800	18·6	105,820
12	1·4	5,330	1·7	5,640	1·3	5,240	1·7	5,840	8·7	31,300	18·9	110,420
13	1·4	5,330	1·6	5,530	1·3	5,240	1·9	5,670	9·1	33,320	19·1	110,420
14	1·6	5,330	1·5	5,425	1·3	5,240	2·1	6,140	9·5	35,400	19·0	109,500
15	1·6	5,330	1·4	5,330	1·2	5,155	2·6	7,000	9·7	36,440	18·8	107,660
16	1·5	5,425	1·6	5,530	1·0	5,000	3·1	8,270	10·0	38,000	18·7	106,740
17	1·5	5,423	1·5	5,425	0·9	4,925	3·3	8,850	10·4	40,220	18·4	103,980
18	1·4	5,330	1·5	5,425	0·9	4,925	3·5	9,390	10·7	41,900	18·0	100,300
19	1·6	5,530	1·5	5,425	0·9	4,925	4·0	10,850	11·1	44,200	17·5	95,710
20	1·6	5,530	1·5	5,425	0·9	4,925	4·8	13,650	11·1	44,200	17·3	93,890
21	1·7	5,640	1·6	5,530	1·0	5,000	3·7	17,340	11·8	48,670	17·1	92,080
22	1·9	5,870	1·7	5,640	1·0	5,000	6·1	19,060	12·7	55,000	17·1	92,080
23	1·8	5,750	1·6	5,530	0·9	4,925	6·4	20,440	13·5	61,170	17·1	92,080
24	1·7	5,640	1·5	5,425	0·9	4,925	6·8	22,280	13·7	62,770	17·1	92,080
25	1·6	5,530	1·5	5,425	1·0	5,000	7·0	23,200	13·9	64,420	17·0	91,200
26	1·6	5,530	1·4	5,330	1·1	5,075	7·0	23,200	14·1	66,080	16·9	90,320
27	1·6	5,530	1·4	5,330	1·2	5,155	7·0	23,200	14·2	66,910	16·9	90,320
28	1·7	5,640	1·3	5,240	1·2	5,155	7·0	23,200	14·2	66,910	16·9	90,320
29	1·7	5,640	.....	.....	1·2	5,155	6·9	22,740	14·3	67,740	16·8	89,440
30	1·8	5,750	.....	.....	1·2	5,155	.....	.....	14·8	70,240	16·6	87,050
31	1·8	5,750	.....	.....	1·3	5,240	.....	.....	15·0	73,600	.....	.....

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DAILY GAUGE HEIGHTS AND DISCHARGES of Thompson River at Spences Bridge for 1913—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge.	Gauge Height	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-t.	Feet.	Sec.-ft	Feet	Sec.-ft.	Feet.	Sec.-ft
1	15·5	86,800	12·0	50,000	9·4	34,800	5·8	22,280	5·0	14,400	3·5	9,390
2	16·4	85,920	11·7	48,020	9·3	34,360	6·6	21,360	4·9	14,020	3·5	9,390
3	16·4	85,920	11·5	46,740	9·1	35,520	6·4	20,440	4·8	16,650	3·5	9,390
4	16·0	82,400	11·4	46,100	9·0	32,800	6·4	20,440	4·7	13,280	3·5	9,390
5	15·6	78,880	11·4	46,100	8·9	32,300	6·4	20,440	4·7	13,280	3·4	9,110
6	15·4	77,120	11·4	46,100	9·0	32,800	6·3	19,980	4·6	12,910	3·4	9,110
7	15·0	73,600	11·6	47,380	9·3	34,360	6·1	19,080	4·6	12,910	3·3	8,830
8	14·6	70,240	11·6	47,360	9·1	32,520	5·9	18,180	4·6	12,910	3·2	8,550
9	14·3	67,740	11·6	47,340	9·1	33,520	5·7	12,340	4·5	12,910	3·3	8,830
10	14·2	66,910	11·6	46,380	9·0	32,800	5·5	16,500	4·6	12,910	3·2	8,550
11	14·1	66,080	11·5	46,740	8·9	32,300	5·4	16,080	4·5	12,550	3·1	8,270
12	14·0	65,250	11·3	45,480	6·7	31,300	5·4	16,080	4·4	12,200	3·0	8,000
13	13·9	64,420	11·3	45,460	8,5	30,300	5·4	16,080	4·3	11,860	2·9	7,740
14	13·8	65,595	11·2	44,820	8·3	29,300	5·4	16,080	4·2	11,520	2·8	7,430
15	13·6	61,970	11·1	44,200	8·2	28,800	5·4	16,080	4·1	11,800	2·7	7,240
16	13·5	61,170	10·9	43,020	8·2	28,800	5·4	16,080	4·1	11,800	2·65	7,120
17	13·3	59,570	10·6	41,340	8·1	28,300	5·4	16,080	4·2	11,520	2·6	7,000
18	13·0	57,250	10·6	41,340	8·0	27,800	5·4	16,080	4·1	12,200	2·6	7,000
19	12·8	55,750	10·5	40,780	8·0	27,800	5·4	16,080	4·2	11,520	2·6	7,000
20	12·5	53,520	10·2	32,100	7·9	27,340	5·4	16,980	4·1	11,180	2·55	6,900
21	12·7	55,000	10·1	38,540	6·0	27,600	5·4	16,080	3·9	10,530	2·5	6,800
22	12·8	55,750	9·9	37,180	7·8	26,800	5·4	16,080	3·8	10,230	2·7	7,240
23	13·0	57,250	9·9	37,180	7·7	26,420	5·3	15,660	3·8	10,230	2·6	7,000
24	13·2	58,770	9·8	36,960	7·6	25,960	5·2	15,240	3·9	10,530	2·5	6,800
25	13·1	58,000	9·7	36,440	7·5	25,500	5·2	15,240	4·1	11,180	2·4	6,520
26	13·2	58,770	9·7	36,440	7·3	24,580	5·2	15,240	4·1	11,180	2·3	6,450
27	13·3	59,570	9·8	36,900	7·2	24,120	5·3	15,660	3·8	10,230	2·2	6,290
28	13·0	57,250	9·9	37,430	7·0	25,200	5·3	15,660	3·8	10,230	2·0	6,000
29	12·8	55,750	9·7	36,110	6·5	22,740	5·5	15,660	3·7	9,950	1·8	5,750
30	12·5	53,520	9·6	35,920	6·9	22,740	5·2	15,240	3·7	9,950	1·8	5,750
31	12·3	52,070	9·5	35,400	.....	.....	5·1	14,820	.....	.....	2·0	6,000

THOMPSON RIVER AT KAMLOOPS.

Location.—Section 6, township 17, range 20, west 6th meridian, just below confluence of the North and South Thompson rivers.

Records Available.—April 1 to September 30, 1911; March 24 to December 31, 1912; April 1 to December 31, 1912.

Winter Conditions.—River generally freezes over completely about 1st of January and remains so until early in March. During 1913-14 the river remained practically open throughout the winter. On March 5, 1912, a metering under ice cover showed a discharge of 3,980 second-feet. This represents the normal run-off during winter months.

Gauge.—A vertical staff gauge read daily by George Clapperton.

Channel.—The width of the channel varies from 100 to 800 feet, while at high water the depth is from 12 to 17 feet greater than at low stages.

Discharge Measurements.—The flow is well defined for a range of discharges from 4,000 to 90,000 second-feet. The stream, as a rule, reaches a maximum of over 100,000 second-feet. The peak of the flood flow is usually about the 20th of June, though this may vary a couple of weeks owing to climatic conditions.

Accuracy.—The accuracy on the whole is of a high degree, and except for the short period during which the flow is greater than 90,000 second-feet, the results as attached are considered to be within 5 per cent of actual conditions.

THOMPSON RIVER AT KAMLOOPS.

The Thompson river has its source at the junction of the North and South Thompson rivers at Kamloops, at an elevation of 1,130 feet and discharges into the Fraser river at Lytton at an elevation of 464 feet high water or 417 feet low water.

The drainage area above Kamloops is 14,400 square miles.

The gauge used is the British Columbia Meteorological Service gauge at the lower traffic bridge at Kamloops, and daily readings have been taken by this survey continuously since September 8, 1911.

Readings are available for this gauge since the summer of 1910, but owing to two changes of datum of uncertain amount, it was not considered advisable to make use of readings except those taken by this survey.

The river rises from the end of March to the middle of June, from 12 to 17 feet, receding slowly until December 1, when freeze-up generally takes place and remains fairly constant till the break-up in March. At low water the mean velocity is about 0·5 feet per second, at high water about 5 feet per second.

DISCHARGE MEASUREMENTS of Thompson River at Kamloops 1911-12, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Sept. 8	C. E. Richardson	1,048	7·15	11,600	1·90	4·37	22,000
Oct. 3	"	1,048	7·06	10,100	1·36	2·50	13,700
Dec. 1	"	1,048	6·95	8,650	0·83	0·50	7,180
1912.							
Mar. 5	"	1,057	6·85	8,030	0·50	.....	3,980[1]
Apr. 8	"	1,057	6·90	8,037	0·51	−0·20	4,090
July 9	"	1,048	7·68	14,300	3·33	8·50	47,700
July 22	"	1,048	7·68	13,100	2·74	7·07	35,900
Aug. 23	"	1,048	7·65	12,300	2·70	6·20	33,400
1913.							
June 6	H. J. Keys	1,057	7·83	17,540	4·95	13·1	86,890

NOTE.—[1]Ice cover.

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Monthly Discharge of Thompson River at Kamloops, for 1913.

(Drainage area, 14,400 square miles.)

Month.	Discharge in Second Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April	16,600	1,900	9,370	0·65	0·72	557,500
May	66,800	15,800	31,265	2·17	2·50	1,924,600
June	100,500	70,200	85,000	5·90	6·58	5,057,800
July	74,500	41,300	54,342	3·77	4·35	3,338,800
August	40,600	27,900	33,968	2·36	2·73	2,090,600
September	29,600	17,100	22,400	1·55	1·73	1,332,900
October	17,500	11,800	13,742	0·96	1·11	842,400
November	12,200	8,100	9,827	0·68	0·76	584,900
December	8,700	5,500	6,974	0·48	0·55	428,570
The period	100,500	1,900	29,654	2·06	21·03	16,158,070

Note.—Accuracy "A".

Daily Gauge Heights and Discharges of Thompson River at Kamloops for 1913.

Day.	April.		May.		June.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge.
1	−1·5	1,900	3·1	16,200	11·2	70,200
2	−1·4	2,000	3·1	16,200	11·6	73,600
3	−1·0	2,500	3·1	16,200	12·1	77,900
4	−1·0	2,500	3·1	16,200	12·4	80,500
5	−0·9	2,700	3·0	15,800	12·7	83,200
6	−0·8	2,900	3·0	15,800	13·0	85,900
7	−0·7	3,100	3·0	15,800	13·0	85,900
8	−0·3	4,100	3·1	16,200	12·8	84,100
9	0·2	5,500	3·3	17,100	13·3	88,600
10	0·2	5,500	3·6	18,400	13·7	92,200
11	0·2	5,500	4·3	21,600	14·1	96,000
12	0·2	5,500	5·0	25,200	14·5	99,600
13	0·2	5,500	5·5	27,900	14·5	99,600
14	0·5	6,400	5·6	28,500	14·5	99,600
15	0,9	7,800	5·7	29,000	14·6	100,500
16	1·4	8,500	5·7	29,000	14·2	96,900
17	1·6	10,200	5·7	29,000	13·6	91,300
18	1·9	11,400	5·8	29,600	13·2	87,700
19	2·1	12,200	5·8	29,600	12·6	82,300
20	2·5	13,700	6·0	30,800	12·2	78,700
21	2·8	14,900	6·3	32,600	12·6	82,300
22	3·1	16,200	6·7	35,000	12·8	84,100
23	3·2	16,600	6·9	36,400	12·5	82,300
24	3·2	16,600	7·2	38,500	12·5	81,400
25	3·1	16,200	7·8	42,700	12·2	78,700
26	3·0	15,800	8·3	16,300	12·2	78,700
27	3·0	15,800	8·8	50,200	12·3	79,600
28	3·1	16,200	9·4	55,000	12·1	77,900
29	3·1	16,200	9·8	58,200	11·9	76,200
30	3·1	16,200	10·4	63,400	11·7	74,500
31			10·8	66,800		

DAILY GAUGE HEIGHTS AND DISCHARGES of Thompson River at Kamloops for 1913—*Continued.*

DAY	July.		August		September.		October		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	11·7	74,500	7·2	38,500	5·5	27,900	3·4	17·500	2·1	12,200	1·0	8,100
2	11·7	74,500	7·0	37,100	5·2	26·300	3·2	16,600	2·0	11,800	1·2	8,700
3	11·6	73,600	7·3	39,200	5·0	25,200	3·2	16,600	2·1	12,200	1·2	8,700
4	11·2	70,200	7·4	39,900	4·9	24,600	3·1	16,200	2·0	11,800	1·2	8,700
5	10·8	66,800	7·3	39,200	4·8	24,100	3·0	15,800	2·0	11,800	1·0	8,100
6	10·3	62,500	7·5	40,600	4·7	23,600	2·8	14,900	1·8	11,000	1·1	8,400
7	10·0	60,000	7·3	39,200	5·8	29,600	2·6	14,100	1·8	11,000	1·1	8,400
8	9·8	58,200	7·2	38,500	5·2	26,300	2·6	14,100	1·7	10,600	1·0	8,100
9	9·9	59,100	7·2	38,500	4·2	21,200	2·4	13,300	1·8	11,000	1·0	8,100
10	9·5	55,800	7·0	37·100	4·5	22,600	2·2	12,500	1·5	9,900	0·8	7,400
11	9·4	55,000	7·0	37,100	4·9	24,600	2·2	12,500	1·5	9,900	0·7	7,000
12	9·5	55,800	6·7	35,000	4·7	23,600	2·1	12,200	1·8	11,000	0·7	7,000
13	9·3	54,200	7·0	37.100	4·6	23,100	2·0	11,800	1·5	9,900	0·7	7,000
14	9·0	51,700	7·0	37,100	4·5	22,600	2·3	12,900	1·3	9,100	0·7	7,000
15	8·9	50,900	6·8	35,700	4·7	23,600	2·3	12,900	1·5	9,900	0·7	7,000
16	8·8	50,200	6·5	33,700	4·6	23,100	3·0	15,800	1·3	9,100	0·7	7,000
17	8·5	47,900	6·3	32,600	4·4	22,100	2·7	14,500	1·2	8,700	0·7	7,000
18	8·4	47,100	6·0	30,800	4·2	21,200	2·8	14,900	1·5	9,900	0·7	7,000
19	8·2	45,600	6·0	30,800	4·4	22,100	2·5	13,700	1·4	9,500	0·6	6,700
20	8·3	46,300	6·0	30,800	4·5	22,600	2·3	12,900	1·2	8,700	0·6	6,700
21	8·4	47,100	6·0	30,800	4·2	21,200	2·2	12,500	1·2	8,700	0·5	6,400
22	8·7	49,400	5·8	29,600	4·1	20,800	2·5	13,700	1·2	8,700	0·5	6,400
23	8·8	50,200	5·7	29,000	4·0	20,300	2·2	12,500	1·2	8,700	0·5	6,400
24	8·9	50,900	5·7	29,000	3·8	19,400	2·2	12,500	1·2	8,700	0·4	6,100
25	8·9	50,900	5·8	29,600	4·1	20,800	2·3	12,900	1·2	8,700	0·3	5,800
26	8·8	50,200	6·0	30,800	3·8	19,400	2·1	12,200	1·2	8,700	0·2	5,500
27	8·7	49,400	5·9	30,200	3·6	18,400	2·5	13,700	1·2	8,700	0·2	5,500
28	8·4	47,100	5·8	29,600	3·3	17,100	2·3	12,900	1·1	8,400	0·2	5,500
29	8·0	44,100	5·7	29,000	3·3	17,100	2·3	12,900	1·1	8,400	0·2	5,500
30	8·0	44,100	5·5	27,900	3·4	17,500	2·3	12,900	1·0	8,100	0·2	5,500
31	7·6	41,300	5·7	29,000			2·2	12,500			0·2	5,500

NORTH THOMPSON RIVER.

Location.—Section 23, township 22, range 17, west 6th meridian., above the "Hefferly riffle."

Records Available.—April 1, 1912, to December 20, 1912; April 13, 1913, to December 31, 1913.

Winter Conditions.—Stream is usually under ice cover from January 1 to April 1. Meterings made of the flow under ice cover showed on Febuary 9, 1912, a discharge of 2,120 second-feet, and on March 12 a discharge of 1,560 second-feet.

Gauge.—A chain gauge is used and daily readings are made by E. Sutton.

Channel.—The channel is about 400 feet wide, and the water is 10 to 15 feet deeper at high than at low stages, mean velocities varying from 0.3 to 5.3 feet per second.

Discharge Measurements.—The flow is well defined by seven well-distributed meter measurements. Considerable difficulty is encountered, however, in securing meterings of maximum flow.

Accuracy.—The accuracy, on the whole, is fairly high (within 10 per cent).

NORTH THOMPSON RIVER.

For general description of North Thompson river see Thompson river at Spences Bridge.

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Discharge Measurements of North Thompson River near Black Pines P. O. 1912 and 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet.	Sq. ft.	Ft. per sec	Feet.	Sec.-ft.
Feb. 9	C. G. Cline	1046	380	4,230	0·5	10·0	2,120*
Mar. 12	C. Richardson	1047	380	4,020	0·39	.....	1,560
April 19	C. G. Cline	1046	380	5,240	1·36	11·6	7,150
June 5	Keys & Dann	1044	400	7,775	3·73	16·8	29,025
April 12	Keys and Cline	1057	390	4,750	0·7	10·3	3,330
1913.							
June 5	Keys and Chisholm	1057	410	11,980	5·2	24·8	62,620
July 22	H. J. E. Keys	1057	420	7,440	4·5	20·2	34,100

* Ice conditions.

Monthly Discharge of North Thompson River near Cooney's Ranch for 1913.

(Drainage area, 7,000 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April	15,060	3,300	7,983	1·14	1·27	474,800
May	55,680	9,950	24,929	3,56	4·10	1,531,000
June	65,360	49,960	57,634	8·23	9·18	3,427,400
July	52,940	33,990	41,874	5,98	6,89	2,576,300
August	41,160	30,980	35,821	5·12	5·90	2,201,300
September	36,040	21,700	26,860	3·84	4·28	1,600,700
October	22,900	15,820	18,766	2,68	3,09	1,156,000
November	16,580	13,160	14,110	2·01	2·24	839,000
December	13,160	9,250	11,367	1·62	1·86	701,000
The period	65,360	3,300	26,594	3·80	38·81	14,507,500

Daily Gauge Heights and Discharges of North Thompson River 1 mile above Jamieson Creek for 1913.

Day.	April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	3,300	12·6	11,000	23·7	57,880
2	.....	3,300	12·4	10,300	24·2	60,080
3	.....	3,300	12·3	9,950	24·4	60,960
4	.....	3,300	12·4	10,300	24·7	62,380
5	.....	3,300	12·4	10,300	24·5	61,500
6	.....	3,400	12·4	10,300	24·4	60,960
7	.....	3,400	12·4	10,300	24·4	60,960
8	.....	3,400	12·4	10,300	24·1	59,640
9	.....	3,400	12·7	11·350	24·6	61,940
10	.....	3,400	13·5	14,300	24·9	63,260
11	.....	3,500	14·9	19,620	25·2	64,480
12	10·3	3,540	15·6	22,500	25·4	65,360
13	10·6	4,380	5·7	22,900	25·1	64,040
14	11·1	5,840	16·0	24,100	24·8	62,820
15	11·5	7,200	16·0	24,100	24·6	61,940
16	11·7	7,880	15·8	23,300	24·0	59,200
17	12·0	8,900	15·9	23,700	23·4	56,560
18	12·2	9,600	15·7	22,900	22·3	51,720
19	12·6	11,000	15·8	23,300	22·0	50,400
20	13·2	13,160	16·1	24,530	21·9	49,960
21	13·2	13,160	16·5	26,250	22·8	58,820
22	13·7	15,060	16·8	27,540	23·2	55,680
23	13·6	14,680	17·2	29,260	22·8	53,820
24	13·5	14,300	17·8	31,840	22·5	52,600
25	13·2	13,160	18·5	34,750	22·6	52,940
26	13·1	12,780	19·1	37,640	22·8	53,820
27	13·0	12,400	19·9	41,160	22·7	53,380
28	13·0	12,400	21·0	46,000	22·5	52,600
29	12·8	11,700	21·8	49·520	22·4	52,160
30	12·7	11,350	22·8	53,820	22·4	52,160
31	.....	.....	23·2	55,680	.....	.....

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DAILY GAUGE HEIGHTS AND DISCHARGES of North Thompson River 1 mile above Jamieson Creek for 1913.—*Continued.*

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	22·4	52,160	18·2	33,560	17·8	31,840	15·4	21,700	14·1	16,580	13·2	13,160
2	22·6	52,940	18·1	33,130	17·3	29,690	15·2	20,900	14·0	16,200	13·2	13,160
3	21·8	49,520	18·7	35·610	17·0	28·400	15·1	20,500	13·9	15·820	13·1	12,780
4	21·4	47,760	19·1	37,640	17·2	29,260	15·0	20,100	13·8	15,440	13·1	12,780
5	21·0	46,000	19·2	38,080	17·6	30,980	14·9	19,620	13·8	15,440	13·0	12,400
6	20·4	43,360	19·4	38·960	18·8	36,040	14·7	18,860	13·6	14·680	13·0	12,400
7	19·9	41,160	19·7	40,280	17·6	30,980	14·5	18,100	13·6	14,680	12·9	12,050
8	20·8	45,120	19·8	40,720	17·4	30,120	14·4	17,720	13·6	14,680	12·9	12,050
9	20·9	45,560	19·9	41,160	17·0	28,400	14·3	17,340	13·5	14,300	13·0	12,400
10	19·9	41,160	19·6	39,840	16·8	27,540	14·2	16,960	13·5	14,300	12·9	12,050
11	20·0	41,600	19·3	38,520	16·7	27,110	14·1	16,580	13·5	14,300	12·9	12,050
12	20·4	43,360	19·4	38,960	16·6	26,680	14·0	16,200	13·5	14,300	12·9	12,050
13	19·8	40,720	19·5	39,400	16·5	26,250	13·9	15,820	13·4	13,920	12·8	11,700
14	19·7	40,280	19·7	40,280	16·6	26,680	14·9	19,620	13·4	13,920		11,700
15	19·4	38,960	19·4	38,960	16·5	26,250	15·7	22,900	13·4	13,920		11,700
16	19·5	39,400	19·1	37,640	16·4	25,820	15·3	21,300	13·4	13,920		11,700
17	18·9	36,470	18·6	35,180	16·3	25,390	15·6	22,500	13·3	13,540		11,700
18	18·6	35,180	18·2	33,560	16·3	25,390	15·5	22,100	13·3	13,540		11,700
19	18·7	35,610	18·2	33,560	16·7	27,110	14·6	18,480	13·3	13,540		11,700
20	18·8	36,040	18·1	33,130	16·8	27,540	14·5	18,100	13·3	13,540		11,700
21	19·2	38,080	18·0	32,700	16·7	27,110	14·5	18,100	13·2	13,160	12·8	11,700
22	19·8	40,720	17·8	31,840	16·6	26,680	14·5	18,100	13·2	13,160	12·6	11,000
23	20·4	43,360	17·6	30,980	16·4	25,820	14·5	18,100	13·2	13,160	12·4	10,300
24	20·5	43,800	18·1	33,130	16·1	24,530	14·5	18,100	13·2	13,160	12·3	9,950
25	20·9	45,560	18·2	33,560	15·8	23,300	14·5	18,100	13·2	13,160	12·1	9,250
26	20·6	44,240	18·3	33,990	15·7	22,900	14·5	18,100	13·3	13,540	12·1	9,250
27	19·9	41,160	18·2	33,560	15·5	22,100	14·5	18,100	13·3	13,540	12·2	9,600
28	19·6	39,840	18·2	33,560	15·4	21,700	14·4	17,720	13·3	13,540	12·3	9,950
29	19·3	38,520	18·0	32,700	15·4	21,700	14·4	17,720	13·2	13,160	12·2	9,600
30	18·9	36,470	18·2	33,560	15·6	22,500	14·3	17·340	13·2	13·160	12·2	9,600
31	18·3	33,990		32,700			14·2	16,960			12·1	9,250

THOMPSON RIVER NEAR CHASE.

Location.—The station is located in township 21, range 13, west 6th meridian, just below Little Shuswap lake, 1 mile from Chase, at the Adams River Lumber Company's wharf.

Records Available.—May to July, 1911; April to December, 1912; April to December, 1913.

Winter Conditions.—The winter conditions in this district are fairly severe, the thermometer going as low as (-20 °F.). The snowfall is about 6 feet. The river generally freezes over or is affected by ice conditions for two or three months each winter.

Gauge.—A vertical staff gauge is used and read by Mr. F. Cook of the Adams River Lumber Company, Chase, B. C.

Channel.—Immediately above the section the river broadens out into Little Shuswap lake. Below the section the river is straight for 200 yards where there is a slight riffle in low water. The river is navigable.

Discharge Measurements.—Eleven well distributed measurements have been made in 1911-12-13. Measurements are made from temporarily established cable and boat.

Accuracy.—Accurate gauge readings are obtained, conditions for metering are favourable; these results should be within 10 per cent.

Discharge Measurements of Thompson River near Chase 1911-12-13.

Date.	Hydrographer.	Meter No.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1911.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec. ft.
Oct. 20	C. E. R.	1048	415	4,450	1·30	0·8½	5,780
1912.							
Mar. 1	"	1047	325	3,710	0·68	0·10	2,384
May 18	"	1047	465	6,480	5·53	5·5	19,600
June 13	"	1048	485	7,190	4·24	7·2	30,800
June 21	"	1047	495	7,600	4·46	8·0	33,800
July 24	"	1047	460	6,200	5·18	5·0	19,600
Sept. 5	"	1049	445	5,180	2·25	2·98	11,600
1913.							
May 12	C. E. R. & J. A. E.	1048	460	5,780	2·26	3·5	13,100
June 10	H. J. E. K.	1057	500	8,390	4,50	9·52	38,100
July 7	"	1057	500	7,850	4·10	8·0	32,400
Oct. 22	K. G. C.	1055	420	4,378	1·51	1·7½	6,627

Monthly Discharge of South Thompson River near Chase for 1913.

(Drainage area, 7,000 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April	9,970	2,800	5,330	0·76	0·85	317,000
May	26,000	10,200	15,119	2·16	2·49	928,000
June	48,300	27,000	41,740	5·96	6·65	2,480,000
July	39,200	22,100	28,987	4·14	4 77	1,780,000
August	21,200	13,000	15,319	2·19	2·52	941,000
September	12,600	9,660	11,364	1·62	1·81	676,000
October	9,360	6,970	7,660	1·09	1·26	471,000
November	6,970	5,850	6,314	0·90	1·00	376,000
December	6,060	4,140	5,170	0·74	0·85	318,000

Note.—First eleven days in April are estimated.

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Daily Gauge Heights and Discharges of South Thompson River near Chase for 1913.

Day.	April.		May.		June.	
	Gauge Height	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			2·8	10,200	6·8	27,000
2			2·9	10,500	7·1	28,500
3			2·9	10,500	7·5	30,600
4			2·9	10,500	7·9	32,600
5			3·0	10,800	8·3	34,700
6			3·0	10,800	8·3	35,800
7			3·0	10,800	8·6	36,400
8			3·0	10,800	8·9	38,000
9			3·0	10,800	9·2	39,800
10			3·1	11,100	9·5	41,500
11			3·3	11,900	9·8	43,200
12	0·0	3,800	3·6	13,000	10·0	44,400
13	0·1	3,970	3·8	13,700	10·3	46,300
14	0·2	4,140	3·9	14,000	10·5	47,600
15	0·3	4,320	4·0	14,400	10·6	48,300
16	0·6	4,860	4·0	14,400	10·6	48,300
17	0·8	5,240	4·1	14,800	10·6	48,300
18	0·8	5,240	4·2	15,200	10·5	47,600
19	1·0	5,640	4·3	15,600	10·5	47,600
20	1·1	5,850	4·4	16,000	10·4	47,000
21	1·4	6,500	4·4	16,000	10·4	47,000
22	1·5	6,730	4·6	16,800	10·3	46,300
23	1·7	7,220	4·8	16,800	10·2	45,700
24	1·8	7,470	4·8	17,600	10·0	44,400
25	1·9	7,720	5·0	18,100	10·0	44,400
26	2·2	8,510	5·1	18,900	9·9	43,800
27	2·3	8,790	5·4	20,200	9·8	43,200
28	2·4	9,070	5·6	21,200	9·7	42,600
29	2·5	9,360	6·0	23,000	9·5	41,500
30	2·7	9,970	6·2	24,000	9·2	39,800
31			6·6	26,000		

DAILY GAUGE HEIGHTS AND DISCHARGES of South Thompson River near Chase for 1913.—*Continued.*

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	9·1	39,200	5·6	21,200	3·5	12,600	2·5	9,360	1·6	6,970	1·2	6,060
2	9·0	38,600	5·3	19,800	3·4	12,200	2·5	9,360	1·6	6,970	1·2	6,060
3	8·8	37,500	5·1	18,900	3·3	11,900	2·4	9,070	1·6	6,970	1·2	6,060
4	8·7	36,900	5·0	18,400	3·3	11,900	2·4	9,070	1·5	6,730	1·2	6,060
5	8·6	36,400	4·9	19,000	3·3	11,900	2·3	8,790	1·5	6,730	1·2	6,060
6	8·4	35,300	4·9	18,000	3·4	12,200	2·2	8,510	1·5	6,730	1·1	5,850
7	8·0	33,100	4·7	17,200	3·4	12,200	2·1	8,240	1·4	6,500	1·1	5,850
8	7·9	32,600	4·5	16,400	3·4	12,200	2·1	8,240	1·4	6,500	1·0	5,640
9	7·8	32,100	4·4	16,000	3·4	12,200	2·0	7,980	1·4	6,500	1·0	5,640
10	7·6	31,100	4·3	15,600	3·4	12,200	1·9	7,720	1·3	6,280	1·0	5,640
11	7·5	30,600	4·2	15,200	3·3	11,900	1·8	7,470	1·3	6,280	0·9	5,440
12	7·4	30,000	4·2	15,200	3·3	11,900	1·9	7,720	1·3	6,280	0·9	5,440
13	7·2	29,000	4·1	14,800	3·3	11,900	1·9	7,720	1·3	6,280	0·8	5,240
14	7·1	28,500	4·1	14,800	3·3	11,900	1·8	7,470	1·3	6,280	0·8	5,240
15	7·0	28,000	4·0	14,400	3·3	11,900	1·8	7,470	1·3	6,280	0·8	5,240
16	7·1	28,500	4·0	14,400	3·2	11,500	1·8	7,470	1·3	6,280	0·8	5,240
17	7·0	28,000	4·0	14,400	3·2	11,500	1·7	7,220	1·3	6,280	0·7	5,050
18	6·9	27,500	4·0	14,400	3·1	11,100	1·7	7,220	1·3	6,280	0·7	5,050
19	6·8	27,000	4·0	14,400	3·1	11,100	1·7	7,220	1·3	6,280	0·6	4,860
20	6·7	26,500	4·0	14,400	3·1	11,100	1·7	7,220	1·2	6,060	0·6	4,860
21	6·6	26,000	4·0	14,400	3·1	11,100	1·7	7,220	1·2	6,060	0·5	4,680
22	6·5	25,500	3·9	14,000	3·0	10,800	1·6	6,970	1·2	6,060	0·5	4,680
23	6·4	25,000	3·9	14,000	2·9	10,500	1·6	6,970	1·2	6,060	0·5	4,680
24	6·3	24,500	3·8	13,700	2·9	10,500	1·6	6,970	1·2	6,060	0·5	4,680
25	6·2	24,000	3·8	13,700	2·9	10,500	1·6	6,970	1·2	6,060	0·5	4,680
26	6·2	24,000	3·7	13,300	2·8	10,200	1·6	6,970	1·2	6,060	0·4	4,500
27	6·1	23,500	3·7	13,300	2·8	10,200	1·6	6,970	1·2	6,060	0·4	4,500
28	6·0	23,000	3·7	13,300	2·8	10,200	1·6	6,970	1·1	5,850	0·4	4,500
29	5·9	22,500	3·7	21,300	2·7	9,970	1·6	6,970	1·1	5,850	0·3	4,320
30	5·8	22,100	3·6	13,000	2·6	9,660	1·6	6,970	1·1	5,850	0·3	4,320
31	5·8	22,100	3·6	13,000	.....	.....	1·6	6,970	.....	.....	0·2	4,140

TRANQUILLE RIVER.

Location.—Section 36, township 20, range 19, west 6th meridian; a mile above Tranquille sanatorium.

Records Available.—July 4, 1911, to October 21, 1911; March 29, 1912, to September 7, 1912; May 1, 1913, to October 31, 1913.

Winter Conditions.—Climatic conditions practically the same as at Kamloops. Stream freezes over duringt he winter of 1911-12. A metering made under ice cover on Febuary 1, 1912, showed a discharge of 8.3 second-feet.

Gauge.—Standard vertical staff gauge read tri-weekly by Eugene Cooney.

Channel.—The channel is straight at the gauge section, the stream bed is composed of stones and boulders and the control is good.

Discharge Measurements.—The gauge-height-discharge curve is well defined for the stream's range.

Accuracy.—The accuracy of returns given is considered to be very high.

TRANQUILLE RIVER.

Tranquille river is about 30 miles long, varying in width from 15 to 50 feet, and in depth from 1 to 6 feet. It rises in township 25, range 19, west of 6th meridian, at an elevation of about 6,000 feet, and discharges into Kamloops lake, whose altitude is 1,125 feet. About 3 miles from the mouth, there is a

canyon 100 feet wide, with steep granite banks. Just above the canyon the right fork of Tranquille river enters. It rises in lake du Bois at an elevation of 2,600 feet. The middle fork joins the Tranquille about 4 miles above the head of the canyon, one branch of which is known as Watching creek, rises in Pass lake (3,300 feet). The main stream fed by the snow of the Sil-Whoia-Kun mountains (6,030 feet) comes from Tranquille lake (4,800 feet). These lakes are difficult of access, and no storage has as yet been possible, although if necessity arose it no doubt could be obtained. The drainage basin of the Tranquille river is sparsely timbered in the lower reaches, but well timbered in the upper part. There are two dams on Tranquille river, both of which have fallen into disuse. They were constructed several years ago by mining interests. The upper dam, on Watching creek, was 20 feet high.

The river station on Tranquille river was established on June 4, 1911, by C. G. Cline. The measuring section is located about 20 feet above Cooney's diversion dam, and 1½ miles above the mouth. This is an excellent section; the control is good, current uniform, banks high, and there is one permanent channel. The measurements are all made by wading. A standard vertical staff gauge is located 100 yards above the dam, and its datum is referred to three benchmarks.

Discharge Measurements of Tranquille River near Kamloops 1911-12-13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
July 4	C. G. Cline	1,046	14	17·70	1·08	0·94	[1]19·10
Sept. 11	do	1,046	13	9·35	0·25	0·60	2·34
1912.							
Feb. 1	G. Stairs	1,053	12	15·35	0·54		[2]8·25
" 1	do	1,046	12	14·90	0·59		[2]8·75
April 13	E. M. Dann	1,046	11	15·20	1·17	0·96	17·80
May 17	do		34	59·20	7·70	2·50	[3]456·00
" 12	do	1,104	36	74·50	7·73	2·70	[3]575·60
" 25	do	1,104	34	52·00	6·04	2·10	[3]313·90
June 1	do	1,104	21	30·50	4·46	1·52	[3]135·96
Aug. 2	H. J. E. Keys	1,057	14	10·30	2·03	0·88	[3]20·90
Sept. 10	do		18	19·20	1·70	1·01	[4]33·20
1913.							
May 5	do	1,057	28	29·00	4·00	1·43	[5]115·00
" 30	do	1,057	18·5	45·80	5·20	2·02	237·00

Note.—[1] At Kamloops lake.
[2] At Cooney's Ranch (Ice conditions).
[3] Foot Bridge.
[4] Cooneys Ranch.
[5] Above Dam.

Monthly Discharge of Tranquille River 1½ miles from Mouth for 1913.

(Drainage area, 230 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	614	117	288·8	1·26	1·45	17,700
June	208	48	96·5	0·42	0·47	5,740
July	153	24	67·1	0·29	0·33	4,130
August	24	7·5	14·5	0·06	0·07	892
September	10	4·1	5·8	0·02	0·02	345
October	14·9	4·1	10·4	0·04	0·05	640

Daily Gauge Heights and Discharges of Tranquille river 1½ miles from Mouth for 1913.

Day.	May.		June.		July.		August.		September.		October.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·5	129	1·8	208	1·4	105	0·95	24	0·75	7·5	0·67	4·1
2	1·5	129	1·75	194	1·35	94	0·95	24	0·75	7·5	0·67	4·1
3	1·52	134	1·67	172	1·4	105	0·82	11·4	0·75	7·5	0·67	4·1
4	1·57	146	1·6	153	1·3	83	0·9	17	0·8	10·0	0·7	5·0
5	1·45	117	1·5	129	1·3	83	0·85	13·5	0·8	10·0	0·7	5·0
6	1·45	117	1·45	117	1·2	62	0·85	13·5	0·75	7·5	0·7	5·0
7	1·65	167	1·4	105	1·2	62	0·9	17	0·75	7·5	0·7	5·0
8	1·75	194	1·35	94	1·17	57	0·9	17	0·72	6·0	0·7	5·0
9	2·6	516	1·35	94	1·15	53	0·85	13·5	0·72	6·0	0·7	5·0
10	2·65	540	1·3	83	1·1	45	0·85	13·5	0·72	6·0	0·7	5·0
11	2·8	614	1·25	72	1·15	53	0·8	10	0·7	5·0	0·75	7·5
12	2·35	402	1·25	72	1·2	62	0·8	10	0·7	5·0	0·77	7·5
13	2·3	380	1·2	62	1·35	94	0·95	24	0·7	5·0	0·8	10
14	2·2	340	1·2	62	1·45	117	0·9	17	0·7	5·0	0·85	13·5
15	2·1	303	1·2	62	1·6	153	0·9	17	0·7	5·0	0·87	14·9
16	2·1	303	1·17	57	1·5	129	0·87	14·9	0·7	5·0	0·87	14·9
17	2·05	286	1·15	53	1·4	105	.....	14·9	0·7	5·0	0·87	14·9
18	2·1	303	1·12	48	1·3	83	.....	14·9	0·7	5·0	0·87	14·9
19	2·1	303	1·15	53	1·2	62	.....	14·9	0·7	5·0	0·87	14·9
20	2·07	293	1·2	62	1·15	53	.....	14·9	0·7	5·0	0·85	13·5
21	2·05	286	1·15	53	1·1	45	.....	14·9	0·7	5·0	0·85	13·5
22	2·05	286	1·2	62	1·2	62	.....	14·9	0·7	5·0	0·85	13·5
23	2·07	293	1·2	62	1·15	53	.....	14·9	0·7	5·0	0·85	13·5
24	2·1	303	1·35	94	1·1	45	0·87	14·9	0·7	5·0	0·85	13·5
25	2·17	329	1·37	99	1·05	38	0·87	14·9	0·7	5·0	0·85	13·5
26	2·15	322	1·5	129	1·05	38	0·85	13·5	0·7	5·0		13·5
27	2·15	322	1·4	105	1·0	30	0·82	11·4	0·7	5·0	Est'd.	13·5
28	2·1	303	1·4	105	1·0	30	0·8	10	0·7	5·0	6 days	13·5
29	2·05	286	1·5	129	1·0	30	0·77	8·5	0·7	5·0	=0·85	13·5
30	2·0	268	1·4	105	0·97	26	0·75	7·5	0·67	4·1		13·5
31	1·9	238	.....	.....	0·95	24	0·75	7·5	.....	.....		13·5

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MISCELLANEOUS METERING STATIONS.

List of Miscellaneous Stream Measurements in Kamloops division, British Columbia Hydrographic Survey, during 1913.

River or Stream.	Location.	Gauging.	Date.	Hydrographer.
Bear Creek	Near mouth	11·1	Nov. 11	K. G. Chisholm.
Campbell Creek	do	13·2	June 17	H. J. Keys.
Cache Creek	Above diversions	16·7	April 26	K. G. C. & C. G. C.
do	do	41·5	May 15	K. G. C.
do	do	12·2	June 9	do
do	do	6·4	July 3	do
Cornwall Creek	do	7·0	May 20	do
Cleme's Creek	Near mouth	7·1	April 23	do
do	do	21·2	May 18	do
Dairy Creek	Above diversion	2·0	June 14	H. J. E. Keys.
Duffy Creek	Near mouth	2·1	June 13	do
Eagle River	Sicamous	1,427·0	Oct. 24	E. M. D. & K. G. C.
Eight Mile Creek	Guichon Creek	15·5	May 22	H. J. E. Keys.
do	Drainage	1·0	Aug. 2	do
do	do	0·5	Aug. 16	do
Fortunes Creek	Below Power House	6·5	Oct. 28	K. G. C.
Fadear Creek	Near mouth	39·1	June 28	H. J. E. K.
Gordon Creek	Above diversions	3·1	April 16	do
Highfalls Creek	At mouth near Celeste	112·0	June 6	E. M. Dann.
Mission Creek	Near mouth	66·4	Nov. 11	E. M. D. & H. J. K.
Murray Creek	Above diversions	26·4	May 8	K. G. C.
do	do	8·0	Oct. 2	do
Maiden Creek	do	1·3	April 30	do
do	do	9·7	May 24	do
Nelson Creek	Above divers. from Barnes Lake	1·2	May 2	do
do	do do	1·0	June 13	do
Oregon Jack Creek	(Basque Ranch)	4·8	May 21	do
do	Above Hammond's headgate	6·2	Aug. 2	do
Power Creek	At mouth	4·1	Nov. 10	E. M. D. & K. G. C.
Ross Creek	Mouth	372·0	June 7	E. M. Dann.
Ray Creek	Near mouth	15·0	May 22	H. J. E. Keys.
Scotch Creek	Mouth	2,422·0	June 8	E. M. Dann.
Shuswap River	Coteau Falls	1,087·0	Oct. 30	E. M. D. & K. G. C.
Seymour River	Mouth	4,272·0	June 5	E. M. Dann.
Three Mile Creek	Kamloops-Savona Rd	2·0	Sept. 3	H. J. E. K.
do	Savona-Merritt Rd	0·5	Sept. 2	H. J. E. K.
Tulameen Creek		857·0	Nov. 16	E. M. D. & K. G. C.
Twenty Mile Creek	Above diversions	13·2	Nov. 15	E. M. D.
Twaal Creek	do	3·4	June 17	C. G. C. & K. G. C.
Venables Creek	do Venables Lake	1·1	May 21	K. G. C.

REPORT

OF

BRITISH COLUMBIA HYDROGRAPHIC SURVEY FOR 1913

CHAPTER 7

Kootenay Boundary Division—Hydrographic Data

CHAPTER VII.

KOOTENAY BOUNDARY DIVISION—HYDROGRAPHIC DATA.

REGULAR METERING STATIONS.

AKOLKOLEX RIVER AT WIGWAM.

Location.—Section 35, township 21, range 7, west 6th meridian, about 1 mile from Wigwam, where the wagon road crosses the river just above the falls.

Records Available.—From May 1 to December 31, 1913.

Winter Conditions.—Heavy snowfall, thermometer rarely goes below zero. Stream at section seldom freezes except for a day or two.

Gauge.—Chain gauge is used, and is referred to three bench-marks. From May to October, inclusive, gauge readings are taken three times a week; during the rest of the year once a week, by J. A. Lewis, Wigwam.

Channel.—Straight for 100 yards above and below the section. The water is swift and flows through a rock box canyon for 150 yards above and below the section. The control is rock and appears very permanent.

Discharge Measurements.—Measurements are made from the upstream side of the wagon bridge. It is difficult to obtain accurate soundings in high water. In 1913, ten well distributed measurements were made.

Accuracy.—Apparently very accurate measurements were made, but due to the infrequency of gauge readings the mean monthly discharge cannot be guaranteed to within 10 per cent. December gauge readings were at times affected by ice.

General.—Akolkolex river is a stream about 20 miles long, rising in township 24, range 28, west 5th meridian, at an elevation of about 6,000 feet, flowing in a south-westerly direction and discharging into Columbia river in township 22, range 1, west 6th meridian, near Wigwam, B.C. It drains an area of over 100 square miles of heavily timbered and unsettled country. There are various falls and canyons between its source and mouth, but the only power possibility which has been investigated is about 1 mile from the mouth. Here the river flows through a canyon for about 150 yards. This canyon is of rock, box-shaped, about 35 feet wide, from 30 to 40 feet deep. At the foot of the canyon the river falls 335 feet in a horizontal distance of 50 yards. A total head of about 400 feet may be obtained and the construction cost will not be prohibitive.

The river above the falls is suitable for driving logs, but not navigable. Valuable timbered limits are held by the Lee Lumber Company, and a good trail has been constructed to these limits near the source of the stream.

The precipitation near the source of the stream is very great, and at the mouth about 40 inches (30 inches rain and 130 inches snow). The summers are hot with considerable rain, winters not particularly severe, the thermometer seldom falling below zero, and the snowfall is very heavy.

Akolkolex River near Wigwam, B.C. Upper Falls.

Akolkolex River near Wigwam, B.C. Lower Falls.

Discharge Measurements of Akolkolex river near Wigwam, B.C. 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 7	C. E. Richardson	1,048	37	157	2·56	2·35	402
May 30	J. A. Elliott	1,672	37	363	7·43	7·50	2,700
June 9	do	1,672	37	455	9·18	10·00	3,990
June 27	do	1,672	37	314	6·40	6·45	2,110
July 17	do	1,672	37	268	4·98	4·90	1,340
July 25	C. E. Richardson	1,048	39	299	5·32	5·75	1,590[1]
Aug. 13	J. A. Elliott	1,672	37	235	4·37	4·28	1,070
Sept. 16	R. G. Swan, C.E.R.	1,048	39	186	2·92	3·10	530
Nov. 20	C. E. Webb	1,048	29	106	1·71	1·75	180

Note.—[1]Section is in box canyon immediately above falls.

Akolkolex River, looking upstream from above falls.

Monthly Discharge of Akolkolex river near Wigwam, B.C., for 1913.

(Drainage area, 105 square miles).

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	2,810	320	1,493	14·22	16·37	91,600
June	4,100	1,980	2,763	26·30	29·34	164,000
July	2,540	1,120	1,768	16·84	19·42	108,000
August	1,630	755	1,088	10·30	11·87	67,000
September	1,300	440	691	6·60	7·36	41,100
October	536	274	344	3·30	3·80	21,100
November	274	175	224	2·13	2·38	13,300
December	175	100	*127	1·21	1·40	7,810

Note.—*Estimated—Last 15 days in December.

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Daily Gauge Heights and Discharges of Akolkolex river near Wigwam, B.C., for 1913.

Day.	May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.
1			8·3	3,030
2			8·6	3,210
3			8·8	3,320
4			9·1	3,500
5			8·4	3,090
6			7·8	2,760
7	2·3	320	9·0	3,440
8	3·0	336	10·1	4,100
9	3·7	795	10·0	4,040
10	4·4	1,080	9·6	3,800
11	4·3	1,040	9·2	3,560
12	4·2	1,000	8·8	3,320
13	4·2	1,000	8·2	2,980
14	4·1	858	7·6	2,650
15	4·0	917	6·9	2,280
16	3·9	875	7·0	2,330
17	3·9	875	7·1	2,380
18	3·9	875	7·2	2,440
19	4·0	917	7·5	2,590
20	4·2	1,000	7·7	2,710
21	5·1	1,390	7·3	2,490
22	6·1	1,880	6·9	2,280
23	6·2	1,930	6·5	2,080
24	6·3	1,980	6·5	2,080
25	6·7	2,180	6·5	2,080
26	7·1	2,380	6·4	2,030
27	7·5	2,590	6·4	2,030
28	7·6	2,650	6·4	2,030
29	7·8	2,760	6·3	1,980
30	7·5	2·590	6·9	2,280
31	7·9	2,810		

DAILY GAUGE HEIGHTS AND DISCHARGES of Akolkolex river near Wigwam, B.C., for 1913—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	7·4	2,540	4·9	1,300	3·9	875	2·6	410	2·1	274	1·7	175
2	6·9	2,280	3·0	1,340	4·1	958	2·5	381	2·1	274	1·7	175
3	6·4	2,030	5·2	1,440	4·4	1,080	2·5	381	2·1	274	1·6	160
4	5·9	1,780	5·4	1,530	4·7	1,220	2·4	353	2·1	274	1·6	160
5	6·4	2,030	5·6	1,630	4·9	1,300	2·3	326	2·1	274	1·6	160
6	6·9	2,280	5·2	1,440	4·5	1,120	2·2	300	2·1	274	1·6	160
7	7·3	2,490	4·8	1,260	4·2	1,000	2·1	274	2·1	274	1·5	145
8	6·7	2,180	4·8	1,260	4·0	917	2·1	274	2·0	249	1·5	145
9	6·0	1,830	4·8	1,260	3·7	795	2·1	274	2·0	249	1·5	145
10	3·8	1,730	4·9	1,300	3·7	795	2·1	274	2·0	249	1·5	145
11	3·6	1,630	5·0	1,340	3·5	716	2·3	326	2·0	249	1·4	130
12	5·4	1,530	5·1	1,390	3·3	641	2·4	353	1·9	224	1·4	130
13	5·2	1,440	4·3	1,040	3·3	641	2·6	410	1·9	224	1·4	130
14	5·0	1,340	4·1	958	3·2	605	3·0	536	1·9	224	1·4	130
15	4·9	1,300	4·0	917	3·1	570	3·0	536	1·9	224	1·4	130
16	4·8	1,260	4·0	917	3·1	570	2·6	410	1·8	194	1·35	122
17	4·9	1,300	4·0	917	3·1	570	2·5	381	1·8	199	1·35	122
18	4·9	1,300	3·9	875	3·1	570	2·4	353	1·8	199	1·35	122
19	6·3	1,980	3·9	875	3·1	570	2·4	353	1·8	199	1·35	122
20	6·6	2,130	3·7	795	3·0	536	2·4	353	1·8	199	1·30	115
21	6·8	2,230	3·6	755	3·0	536	2·4	353	1·8	199	1·30	115
22	7·0	2,330	3·7	795	3·0	536	2·4	353	1·8	199	1·30	115
23	7·1	2,380	3·8	835	2·9	503	2·3	326	1·8	199	1·20	100
24	6·6	2,130	3·9	875	2·8	471	2·3	326	1·8	199	1·20	100
25	5·9	1,780	4·0	917	2·7	440	2·3	326	1·8	199	1·20	100
26	5·4	1,530	4·1	958	2·7	440	2·2	300	1·8	199	1·20	100
27	5·0	1,340	4·1	958	2·7	440	2·2	300	1·8	199	1·20	100
28	4·5	1,120	4·2	1,000	2·7	440	2·2	300	1·7	175	1·20	100
29	4·6	1,170	4·2	1,000	2·7	440	2·1	274	1·7	175	1·20	100
30	4·6	1,170	4·1	958	2·7	440	2·1	274	1·7	175	1·20	100
31	4·8	1,260	4·0	917	.....	.....	2·1	274	.....	.....	1·11	100

BEAVER RIVER AT SIX-MILE CREEK.

Location.—Township 29, range 25, west 5th meridian, 4 miles from the mouth, about 150 yards from the railway station at Six-mile creek, on the downstream side of the lumber company's bridge.

Records Available.——From May 24 to November 1, 1913.

Winter Conditions.—Severe (-30° F.) with heavy snowfall. Ice conditions exist generally from November to the end of March. Frazil ice is to be contended with.

Gauge.—Chain gauge is used and referred to three bench-marks. Wm. McCreary reads the gauge daily at 5 p.m., at which time the river during the summer freshet is considered to be at a mean height for the day.

Channel.—Straight for 100 yards above and below the section. The river is very swift during high water, and accurate soundings can only be made at low water. During the freshet in June, July and August, water flows through two or three small side channels. As yet the control has not been studied, but appears permanent.

Discharge Measurements.—Measurements are made from the downstream side of the bridge. In 1913, ten discharge measurements were made, one of which was made under ice conditions on December 3, giving a discharge of 330 c.f.s.

Accuracy.—The gauge-height-discharge curve shows a close accuracy though the section does not appear to be good. The fact that during the summer the

river varies greatly on a warm day depreciates the accuracy of the gauge reading. The 1913 data are within 15 per cent only.

General.—Beaver river has its source in the Grand glacier of the Selkirk range at Duncan pass in township 24, range 24, west 6th meridian, at an elevation of about 6,000 feet. It is 40 miles long, and flows in a northerly direction, discharging into the Columbia near Beavermouth, at an elevation of about 2,500 feet. It drains an area of about 400 square miles of heavily timbered, very mountainous country. The C.P.R. main line runs up the valley from Beavermouth for 15 miles to Bear creek near Rogers pass, and the river, in its lower reaches, winding across a broad valley, is familiar to thousands of tourists. Its upper reaches are uninhabited except at Rogers pass, and only C.P.R. employees and a lumber camp may be found near the mouth.

The scattered bits of agricultural lands have not been taken up and at present the only industry in this watershed is lumbering. In 1913 the McCreary Lumber Company started operations at Six-mile creek. Valuable limits are held by the company.

There are no pronounced falls or rapids in the upper part of the river, but near the mouth there is the Natural Arch (or Gateway) close to the railway. There is a fall in the river of about 80 feet in a distance of 3,000 feet, the river being only from 20 to 40 feet wide with rocky banks. At the head of the rapids the C.P.R. rail is only 15 feet above high-water mark, and at the foot it is 25 feet above high water. A dam at the head of the rapids would give excellent pondage. Any development is restricted by the proximity of the present grade of the railway.

DISCHARGE MEASUREMENTS of Beaver River near Six-mile Creek 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 24	C. E. R.	1,048	147	357	8·51	3·00	3,040
June 5	"	1,048	154	601	8·00	4·30	4,840
June 12	J. A. E.	1,672	156	656	8·26	4·65	5,420
July 7	"	1,672	150	609	8·61	4·55	5,240
July 20	"	1,672	149	485	9·20	4·20	4,460
Sept. 15	C. E. R. & R. G. S.	1,048	75	231	6·02	2·05	1,390
Dec. 3	C. E. W.	1,048	45	122	2·87	0·45	330

MONTHLY DISCHARGE of Beaver River near Six-mile Creek for 1913.

(Drainage area, 400 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
June	6,420	2,720	4,640	11·6	12·9	276,000
July	5,300	2,460	4,140	10·4	12·0	255,000
August	4,940	2,340	3,880	9·71	11·2	239,000
September	4,100	1,350	2,070	5·17	5·77	123,000
October	1,980	560	1,130	2·83	3·26	69,600

NOTE.—Station established May 24, 1913.
Gauge readings discontinued October 31, 1913.

Daily Gauge Heights and Discharges of Beaver River near Six-mile Creek for 1913.

Day.	May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			4·7	5,480
2			4·7	5,480
3			4·8	5,660
4			4·6	5,300
5			4·3	4,770
6			4·2	4,600
7			4·4	4,940
8			5·0	6,020
9			5·0	6,020
10			5·2	6,420
11			5·0	6,020
12			4·9	5,840
13			4·8	5,660
14			4·3	4,770
15			3·9	4,100
16			3·6	3,620
17			3·4	3,320
18			3·5	3,470
19			4·5	5,120
20			4·4	4,940
21			3·9	5,120
22			3·0	2,720
23			3·7	3,780
24	3·0	2,720	3·9	4,100
25	3·5	3,470	3·7	3,780
26	3·7	3,780	3·6	3,620
27	3·9	4,100	3·6	3,620
28	4·2	4,600	3·7	3,780
29	4·0	4,260	3·8	3,940
30	4·0	4,260	4·0	4,260
31	4·3	4,770		

DAILY GAUGE HEIGHTS AND DISCHARGES of Beaver River near Six-mile Creek for 1913—*Continued.*

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge	Gauge Height	Discharge.	Gauge Height.	Discharge.	Gauge Height	Discharge	Gauge Height	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	4·1	4,430	3·9	4,100	3·3	3,170	1·8	1,350	0·8	560	...	.....
2	3·9	4,100	4·0	4,260	3·6	3,620	2·4	1,980				
3	3·4	3,320	4·2	4,600	3·9	4,100	2·1	1,640			0·45	350
4	3·3	3,170	4·1	4,430	3·1	2,870	1·8	1,350			...	....
5	3·5	3,470	4·0	4,260	3·2	3,020	1·8	1,350				...
6	3·9	4,100	3·9	4,100	2·8	2,460	1·9	1,440				..
7	4·6	5,300	4·3	4,770	2·7	2,340	1·7	1,260				..
8	3·9	4,100	4·4	4,940	2·7	2,340	1·7	1,260				..
9	4·0	4,260	4·1	4,430	2·6	2,220	1·8	1,350				..
10	4·3	4,770	4·2	4,600	2·5	2,100	1·7	1,260				..
11	4·0	4,260	4·1	4,430	3·0	2,720	1·7	1,260				..
12	3·9	4,100	4·0	4,260	2·6	2,220	1·6	1,170				..
13	3·5	3,470	3·9	4,100	2·7	2,340	1·7	1,260				..
14	3·3	3,170	3·7	3,780	2·5	2,100	1·6	1,170				..
15	3·0	2,720	3·8	3,940	2·1	1,640	1·7	1,260				..
16	3·1	2,870	3·6	3,620	2·0	1,540	1·7	1,260				..
17	3·0	2,720	3·5	3,470	2·0	1,540	1·6	1,170				..
18	2·8	2,460	3·3	3,170	2·5	2,100	1·7	1,260				..
19	4·1	4,430	3·4	3,320	2·1	1,640	1·6	1,170				..
20	4·6	5,300	3·0	2,720	2·0	1,540	1·6	1,170				..
21	4·5	5,120	2·7	2,340	2·2	1,750	1·5	1,080				..
22	4·6	5,300	3·2	3,020	2·0	1,540	1·4	1,000				....
23	4·6	5,300	3·9	4,100	1·9	1,440	1·3	920				
24	4·6	5,300	3·8	3,940	1·9	1,440	1·2	840				
25	4·6	5,300	3·6	3,620	1·8	1,350	1·1	770				..
26	4·5	5,120	3·8	3,940	1·9	1,440	1·1	770				..
27	4·5	5,120	3·5	3,470	1·8	1,350	1·0	700				..
28	4·4	4,940	3·8	3,940	1·9	1,440	1·1	770				..
29	3·8	3,940	3·6	3,620	1·8	1,350	1·0	700				..
30	3·0	2,720	3·4	3,320	1·8	1,350	0·8	560				..
31	3·6	3,620	3·7	3,780	...	.....	0·9	630				..

BLAEBERRY RIVER.

Location.—South-west $\frac{1}{4}$ section 29, township 28, range 22, west 5th meridian, 11 miles north of Golden, about 1 mile from the mouth, on the downstream side of the C.P.R. bridge.

Records Available.—April 15, 1912, to November 14, 1912; June 1, 1913, to November 30, 1913.

Winter Conditions.—Severe (-30 °F.) with heavy snowfall. Ice conditions exist generally from the middle of November to the 1st of April. Frazil ice.

Gauge.—A vertical staff gauge is used and read three times a week, by H. M. Cooper, during the open season.

Channel.—The channel is straight for about 50 yards above and below the station. The water is swift and controlled by a sandbar about 100 yards downstream. This bar probably shifts. Exceedingly high water on the Columbia may effect the gauge readings.

Discharge Measurements.—Measurements are made from the downstream side of the railway bridge. In 1912 eight meterings were made, one of which was made on the 21st of February under ice conditions, the discharge was 53 c.f.s; in 1913 nine meterings were made, which formed a gauge-height-discharge curve varying considerably from that of 1912.

Accuracy.—Due to the infrequency of gauge readings and the apparent non-permanency of the control, the results are guaranteed only to be within 15 per cent.

Discharge Measurements of Blaeberry River at C. P. R. Bridge 1911-13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Oct. 16	C. E. Richardson	1,048	68	177	1·75	0·90	310·0
Feb. 21	"	1,048	51	148	0·413	.....	(1)53·5
1912.							
June 6	H. C. Hughes	1,055	70	199	2·43	1·40	484·0
June 7	"	1,055	78	237	3·15	1·905	746·0
June 25	"	1,055	86	398	7·28	3·50	2,900·0
July 11	"	1,055	80	293	4·52	2·72	1,330·0
July 27	"	1,055	80	279	4·08	2·43	1,140·0
Oct. 3	C. E. Richardson	1,055	70	215	2·40	1·40	512·0
1913.							
May 24	J. A. Elliott	1,672	80	290	4·59	2·45	1,330·0
June 15	"	1,672	82	340	5·90	3·10	2,010·0
July 5	"	1,672	81	310	4·94	2·70	1,500·0
July 5	"	1,672	83	310	4·89	2·70	1,510·0
July 23	"	1,672	83	360	6·36	3·32	2,290·0
Aug. 2	"	1,672	80	341	6·33	3·15	2,160·0
Sept. 5	C. E. Richardson	1,048	80	335	5·60	3·02	1,880·0
Sept. 16	J. A. Elliott	1,672	75	250	3·64	1·90	910·0
Nov. 30	C. E. Webb	1,048	52	154	1·38	0·50	212·0

Note—(1) Ice conditions.

Monthly Discharge of Blaeberry River at Golden for 1913.

(Drainage area, 325 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
June	3,460	1,530	2,449	7·54	8,41	146,000
July	2,740	1,270	1,875	5·77	6·65	115,000
August	2,749	1,030	1,838	5·66	6·52	113,000
September	1,440	720	1,058	3·26	3·64	63,000
October	900	370	607	1·87	2·16	37,300
November	415	170	274	0·84	0·94	16,300

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Daily Gauge Heights and Discharges of Blaeberry River near Golden for 1913.

Day.	June.		July.		August.		September.		October.		November.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	3·8	3,100	3·5	2,580	3·2	2,120	2·4	1,270	1·9	900	0·9	370
2	3·7	2,920	3·2	2,120	3·4	2,420	2·5	1,350	1·7	775	1·0	415
3	3·5	2,580	2·9	1,730	3·5	2,580	2·5	1,350	1·6	720	1·0	415
4	3·4	2,420	2·8	1,620	3·6	2,740	2·6	1,440	1·6	720	0·9	370
5	3·3	2,270	2·8	1,620	3·6	2,740	2·6	1,440	1·5	665	0·9	370
6	3·4	2,420	2·9	1,730	3·5	2,580	2·5	1,350	1·5	665	0·9	370
7	3·5	2,580	3·0	1,850	3·5	2,580	2·5	1,350	1·5	665	0·9	370
8	3·7	2,920	3·1	1,980	3·5	2,580	2·6	1,440	1·6	720	0·8	330
9	3·8	3,100	3·0	1,850	3·4	2,420	2·5	1,350	1·6	720	0·8	330
10	3·8	3,100	2·9	1,730	3·3	2,270	2·4	1,270	1·7	775	0·7	290
11	3·7	2,920	2·9	1,730	3·2	2,120	2·3	1,190	1·8	835	0·7	290
12	3·7	2,920	2·8	1,620	3·2	2,120	2·2	1,110	1·7	775	0·6	250
13	3·6	2,740	2·7	1,530	3·1	1,980	2·0	965	1·5	665	0·6	250
14	3·4	2,420	2·5	1,350	3·0	1,850	2·1	1,030	1·5	665	0·5	210
15	3·1	1,980	2·5	1,350	2·8	1,620	2·2	1,110	1·4	610	0·4	170
16	2·9	1,730	2·4	1,270	2·8	1,620	2·1	1,030	1·4	610	0·6	250
17	2·7	1,530	2·5	1,350	2·7	1,530	2·0	965	1·3	555	0·7	290
18	3·4	2,120	2·6	1,440	2·7	1,530	2·0	965	1·2	505	0·7	290
19	4·0	3,460	2·8	1,620	2·6	1,440	2·0	965	1·2	505	0·6	250
20	3·9	3·280	3·1	1,980	2·5	1,350	1·9	900	1·3	555	0·6	250
21	3·8	3,100	3·4	2,420	2·3	1,190	1·9	900	1·3	555	0·5	210
22	3·5	2,580	3·5	2,580	2·2	1,110	1·9	900	1·4	610	0·5	210
23	3·1	1,980	3·6	2,740	2·1	1,030	1·8	835	1·3	555	0·5	210
24	3·1	1,980	3·5	2,580	2·3	1,190	1·7	775	1·1	460	0·5	210
25	3·0	1,850	3·4	2,420	2·5	1,350	1·6	720	1·1	460	0·5	210
26	2·9	1,730	3·3	2,270	2·8	1,620	1·6	720	1·1	460	0·5	210
27	2·8	1,620	3·2	2,120	2·7	1,530	1·6	720	1·1	460	0·5	210
28	3·0	1,850	3·0	1,850	2·6	1,440	1·6	720	1·1	460	0·5	210
29	3·2	2,120	2·9	1,730	2·6	1,440	1·7	775	1·0	415	0·5	210
30	3·0	1,850	2·7	1,530	2·7	1,530	1·8	835	1·0	415	0·5	210
31	.....	.....	3·0	1,850	2·5	1,350	.....	.....	0·9	370	.....	.....

BUGABOO CREEK.

Location.—About 3 miles southwest of Spillimacheen Landing, 40 miles south of Golden, on the downstream side of the highway bridge, 1 mile from the mouth.

Records Available.—June to October, 1912; June to November, 1913.

Winter Conditions.—Severe (-40 °F.) with heavy snowfall, the creek usually freezes over in November and does not open again till April. Frazil ice.

Gauge.—Vertical staff gauge fastened to the pier of the bridge, and read daily, during the open season, by Jas. Montgomery.

Channel.—Straight for 100 feet above and below the gauge; the water is swift during freshet; there is one channel in low water, and two in high water.

Discharge Measurements.—Meterings are taken from the downstream side of the bridge, four being taken in 1912, and eight in 1913.

Accuracy.—The control has not been thoroughly studied. The 1913 gauge heights do not give the same discharges as corresponding gauge heights in 1912; a slight possibility of backwater from the Columbia river when the latter stream is extremely high; 1913 results on the Bugaboo are guaranteed to be within 10 per cent.

Discharge Measurements of Bugaboo River near Spillimacheen, 1912-13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet.	Sec.-ft.	Ft. per sec.	Feet.	Sec.-ft.
June 1	H. C. Hughes	1,055	33·0	96·3	2·89	1·45	278
June 8	do	1,055	60·0	138·0	6·08	2·40	839
July 16	do	1,055	59·0	128·0	5·34	2·15	684
Sept. 29	C. E. Richardson	1,055	33·0	858·0	1·87	1·02	161
1913							
May 20	J. A. Elliott	16,72	34·5	103·0	2·94	1·35	303
June 23	do	16,72	60·0	152·0	6·88	2·40	1,040
July 11	C. E. Richardson	1,048	60·0	150·0	6·87	2·40	1,030
July 27	J. A. Elliott	1,072	60·0	158·0	6·66	2·38	1,050
July 30	do	1,672	60·0	130·0	5·70	2·05	744
Sept. 3	C. E. R. & R. G. S.	1,048	34·0	118·0	4·04	1·85	478
Sept. 14	J. A. Elliott	1,672	34·0	111·0	3·65	1·69	406
Nov. 26	C. E. Webb	1,048	33·0	84·7	1·36	1·00	115

Monthly Discharge of Bugaboo River near Spillimacheen for 1913.

(Drainage area, 190 square miles.)

Month.	(Discharge in Second-Feet.)				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
June	2,910	820	1,654	8·70	9·71	98,200
July	1,650	570	1,070	5·63	6·49	65,800
August	1,390	510	878	4·62	5·33	54,000
September	1,790	350	569	2·99	3·34	33,900
October	400	160	292	1,54	1·78	17,900
November	220	85	145	0·76	0·85	8,630

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Daily Gauge Heights and Discharges of Bugaboo River near Spillimacheen for 1913.

Day.	May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			3·0	1,790
2			3·0	1,790
3			3·1	1,930
4			3·1	1,930
5			3·1	1,930
6			2·9	1,650
7			2·9	1,650
8			3·3	2,210
9			3·8	2,910
10			3·6	2,630
11			3·5	2,490
12			3·5	2,490
13			3·2	2,070
14			3·1	1,930
15			3·0	1,790
16			2·4	1,040
17			2·2	820
18			2·3	930
19			2·4	1,040
20	1·4	305	2·9	1,650
21	1·5	350	2·6	1,270
22	1·8	510	2·5	1,150
23	2·0	640	2·4	1,040
24	2·1	720	2·6	1,270
25	2·2	820	2·7	1,390
26	2·5	1,150	2·7	1,390
27	2·6	1,270	2·7	1,390
28	2·7	1,390	2·6	1,270
29	2·7	1,390	2·7	1,390
30	2·7	1,390	2·7	1,390
31	2·8	1,520		

DAILY GAUGE HEIGHTS AND DISCHARGES of Bugaboo River near Spillimacheen for 1913—*Continued.*

Day.	July.		August.		September.		October.		November.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·7	1,390	2·4	1,040	1·9	570	1·5	350	1·1	185
2	2·6	1,270	2·5	1,150	1·7	450	1·6	400	1·1	185
3	2·4	1,040	2·6	1,270	1·8	510	1·5	350	1·0	160
4	2·4	1,040	2·5	1,150	3·0	1,790	1·5	350	1·2	220
5	2·3	930	2·6	1,270	2·8	1,520	1·4	305	1·1	185
6	2·3	930	2·7	1,390	2·2	820	1·5	350	1·0	160
7	2·9	1,650	2·5	1,150	2·0	640	1·5	350	1·0	160
8	2·6	1270	2·7	1,390	1·9	570	1·6	400	1·1	185
9	2·5	1,150	2·4	1,040	2·1	720	1·5	350	1·1	185
10	2·5	1,150	2·3	930	1·9	570	1·4	305	1·1	185
11	2·4	1,040	2·3	930	1·8	510	1·5	350	1·1	185
12	2·3	930	2·5	1,150	1·8	510	1·6	400	1·0	160
13	2·3	930	2·5	1,150	1·8	510	1·6	400	1·0	160
14	2·1	720	2·2	820	1·7	450	1·5	350	1·0	160
15	2·0	640	2·1	720	1·6	400	1·4	305	1·1	185
16	1·9	570	1·9	570	1·6	400	1·4	305	1·1	185
17	1.9	570	1·9	570	1·7	450	1·4	305	1·0	160
18	2·1	720	1·9	570	2·1	720	1·3	260	1·0	160
19	2·2	820	1·9	570	1·8	510	1·3	260	1·0	160
20	2·6	1,270	1·8	510	1·6	400	1·2	220	0·3	85
21	2·7	1,390	1·8	510	1·6	400	1·2	220	Mean for 10 days=·05.	Discharge=950 (10 days).
22	2·8	1,520	2·0	640	1·8	510	1·2	220		
23	2·9	1,650	2·0	640	1·6	400	1·2	220		
24	2·7	1,390	2·2	820	1·6	400	1·4	305		
25	2·7	1,390	2·1	720	1·5	350	1·2	220		
26	2·5	1,150	2·2	820	1·5	350	1·2	220		
27	2·5	1,150	2·1	720	1·6	400	1·2	220		
28	2·3	930	2·0	640	1·6	400	1·2	220		
29	2·3	930	2·1	720	1·7	450	1·1	185		
30	2·2	820	2·2	820	1·6	400	1·0	160		
31	2·2	820	2·2	820	.....	.....	1·1	185		

COLUMBIA RIVER, GOLDEN.

Location.—Southwest ¼ section 12, township 27, range 22, west 5th meridian. above mouth of Kicking Horse river, 1 mile from Golden, B. C., 100 yards below the Columbia River Lumber Company's mill.

Records Available.—During the open season from 1903–13. Gauge heights from 1903–11 were obtained through the courtesy of the Columbia River Lumber Company. One ice measurement made in February, 1912, gave discharge of 795 c.f.s., and one made in February, 1914, gave discharge of 894 c.f.s.

Winter Conditions.—The winters are severe (-40 °F.) with heavy snowfall. Ice conditions generally exist from the middle of November to the end of March.

Gauge.—Vertical staff gauge referred to three bench-marks, and read daily by the Columbia River Lumber Company, during the open season.

Channel.—The section is located in the middle of a straight stretch of river of 1,500 feet. At low water there is a pronounced riffle 300 yards below gauge but at high water this riffle disappears.

Discharge Measurements.—Measurements are made from boat held by temporary cable about 100 yards below mill, eight discharge measurements were made in 1912, and five in 1913.

Accuracy.—The gauge readings are good. Great difficulty is encountered in metering river at high water, and during June and July accuracy is not guaranteed to within 15 per cent, but in the remaining months it is probably within 10 per cent.

Discharge Measurements of Columbia River near Golden, B. C., 1911-12-13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911.			Feet.	Sq. ft.	Ft. per sec.	Ft. In.	Sec. ft.
Oct. 17	C. E. Richardson	1048	176	792	2·36	10 9	1,870
1912.							
Feb. 20	"	1048	175	615	1·27	.....	795[1]
June 4	H. C. Hughes	1055	200	1,030	3·02	9 2·0	3,100
" 8	"	1055	220	1,270	3·52	8 0·6	4,490
" 24	"	1055	440	2,485	4·35	5 0·6	10,800
July 24	"	1055	385	1,910	4·60	5 4·3	8,820
" 28	"	1055	373	2,010	4·14	5 7·7	8,300
Oct. 1	C. E. Richardson	1055	180	798	2·53	10 6·0	2,020
1913.							
May 23	J. A. Elliott	1672	200	1,060	3·42	3 7·0	3,620[2]
June 16	C. E. R and J. A. E.	1672	400	3,710	5·40	2 1·5	20,000
July 4	" "	1672	400	2,690	4·20	4 0·0	11,300
Sept. 16	J. A. Elliott	1672	270	1,280	4·17	8 1·0	5,340[3]
Nov. 24	C. E. Webb	1048	185	764	2·20	18 3·0	1,670[3]

[1] Ice conditions. [2] Different gauge. [3] 8′ 1″ on one gauge = 4·48 on other; zero on one gauge (feet and inches) at top, zero on other gauge (feet and tenths) at bottom.

Monthly Discharge of Columbia River near Golden, B. C., for 1913.

(Drainage area, 2,500 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April	2,000	1,530	1,647	0·66	0·74	97,600*
May	9,300	1,600	3,627	1·45	1·67	22,300
June	18,600	9,760	14,402	5·76	6·43	857,000
July	12,600	9,070	11,154	4·46	5·14	688,000
August	9,760	6,660	8,303	3·32	3·83	510,000
September	8,840	6,610	6,817	2·73	3·05	405,000
October	6,060	2,660	3,875	1·55	1·79	238,000
November	2,560	1,320	1,873	0·74	0·83	111,000

* First 11 days estimated.

Daily Gauge Heights and Discharges of Columbia River near Golden for 1913.

Day.	April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			10·9	1,750	5·4	9,760
2			10·10	1,750	5·1	10,200
3			10·10	1,750	4·9	10,900
4			10·10	1,750	4·6	11,600
5			10·11	1,670	4·4	12,000
6			11·0	1,600	4·2	12,200
7			11·0	1,600	4·0	12,600
8			11·0	1,600	3·10	13,100
9			10·8	1,830	3·8	13,400
10			10·6	2,000	3·2	14,900
11			10·4	2,180	2·10	16,100
12			10·0	2,460	2·6	17,000
13			10·0	2·460	2·1	18,200
14	11·1	1,530	9·10	2,660	2·0	18,600
15	10·11	1,670	9·8	2,760	2·1	18,200
16	10·8	1,830	9·6	2,960	2·1	18,200
17	10·6	2,000	9·8	2,760	2·1	18,200
18	10·6	2,000	9·8	2,760	2·0	18,600
19	10·6	2,000	9·8	2,760	2·2	17,900
20	10·6	2,000	9·9	2,660	2·4	17,600
21	10·6	2,000	9·11	2,560	3·0	15,500
22	10·7	1,910	8·0	5,010	3·8	13,400
23	10·7	1,910	8·4	4,560	3·9	13,400
24	10·8	1,830	7·10	5,310	3·9	13,400
25	10·8	1,830	7·6	5,760	3·10	13,100
26	10·8	1,830	7·2	6,210	3·11	12,800
27	10·9	1,750	7·1	6,360	3·9	13,400
28	10·9	1,750	6·9	6,960	4·0	12,600
29	10·9	1,750	6·3	7,610	4·0	12,600
30	10·9	1,750	5·8	9,070	4·0	12,600
31			5·6	9,300		

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DAILY GAUGE HEIGHTS AND DISCHARGES of Columbia River near Golden for 1913—*Continued.*

Day.	July.		August.		September.		October.		November.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	4·0	12,600	5·7	9,070	7·0	6,510	7·4	6,060	9·11	2,560
2	4·0	12,600	5·7	9,070	7·0	6,510	7·4	6,060	9·11	2,560
3	4·0	12,600	5·6	9,300	7·0	6,510	7·3	6,060	10·0	2,460
4	4·0	12,600	5·6	9,300	7·0	6,510	7·8	5,460	10·0	2,460
5	4·1	12,400	5·6	9,300	7·2	6,210	8·0	5,010	10·1	2,360
6	4·2	12,200	5·5	9,530	7·3	6,060	8·0	5,010	10·1	2,360
7	4·3	12,200	5·5	9,530	7·3	6,060	8·2	4,710	10·3	2,180
8	4·4	12,000	5·5	9,530	7·5	5,910	8·4	4,560	10·3	2,180
9	4·5	11,800	5·4	9,760	7·4	6,060	8·7	4,110	10·3	2,180
10	4·5	11,800	5·4	9,760	7·2	6,210	8·9	3,810	10·4	2,180
11	4·6	11,600	5·8	8,840	7·0	6,510	8·9	3,810	10·4	2,180
12	4·6	11,600	5·8	8,840	6·5	7,440	8·9	3,810	10·5	2,090
13	4·7	11,400	5·9	8,610	6·2	7,790	8·9	3,810	10·6	2,000
14	4·7	11,400	5·9	8,610	5·8	8,840	8·10	3,810	10·8	1,830
15	4·7	11,400	5·10	8,610	5·8	8,840	8·10	3,810	10·8	1,830
16	4·8	11,100	5,10	8,610	5·8	8,840	8·11	3,670	10·9	1,750
17	4·8	11,100	6·0	8,180	5·9	8,610	8·11	3,670	10·10	1,750
18	4·10	10,900	6·1	7,980	6·0	8,180	9·0	3,540	10·10	1,750
19	5·0	10,400	6·2	7,790	6·1	7,980	9·2	3,300	10·10	1,750
20	5·4	9,760	6·4	7,610	6·5	7,440	9·3	3,180	10·10	1,750
21	5·6	9,300	6·4	7,610	6·7	7,110	9·3	3,180	10·11	1,670
22	5·7	9,070	6·2	7,790	6·8	6,960	9·3	3,180	11·0	1,600
23	5·6	9,300	6·2	7,790	7·0	6,510	9·3	3,180	11·2	1,460
24	5·4	9,760	6·3	7,610	7·3	6,060	9·4	3,180	11·4	1,390
25	5·2	9,990	6·5	7,440	7·6	5,760	9·5	3,070	11·5	1,320
26	5·0	10,400	6·7	7,110	7·7	5,610	9·5	3,070	11·5	1,320
27	4·10	10,900	6·8	6,960	7·6	5,760	9·6	2,960	11·5	1,320
28	4·9	10,900	6·9	6,960	7·5	5,910	9·6	2,960	11·5	1,320
29	4·9	10,900	6·10	6,810	7·5	5,910	9·8	2,760	11·5	1,320
30	4·9	10,900	6·10	6,810	7·5	5,910	9·10	2,660	11·5	1,320
31	4·9	10,900	6·11	6,660	.....	.....	9·10	2,660	.....	.....

COLUMBIA RIVER NEAR REVELSTOKE.

Location.—Southeast ¼ section 33, township 23, range 2, west 6th meridian, above the mouth of the Illicillewaet river on the downstream side of the highway bridge near Revelstoke.

Records Available.—1912–13, during open season.

Winter Conditions.—Severe with heavy snowfall; ice conditions exist generally from November to the end of March. Frazil ice.

Gauge.—Chain gauge used and daily readings taken during open season by J. H. Jones.

Channel.—About 1,000 feet wide, controlled by a fairly permanent sandbar 500 yards below. Shift in 1913 apparently caused by the building of a breakwater at the control.

Discharge Measurements.—Eleven well distributed measurements taken during 1911-12-13. Miscellaneous ice cover metering taken on February 27, 1912. Discharge 4,460 c.f.s.

Accuracy.—Accurate gauge reading, fair conditions for metering. These results are guaranteed to be within 5 per cent.

Discharge Measurements of Columbia river near Revelstoke, B. C., 1911-12-13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Height.	Discharge
1911.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Oct. 12.....	C. E. Richardson	1048	705	4,990	2·66	5·45	13,300
1912.							
Feb. 27.	"	1048	523	3,160	1·41	.....	[1]4,460
April 19.....	"	1048	710	5,140	2·60	5·54	13,000
June 18.....	"	1048	960	12,500	7·80	15·50	96,900
June 24.....	"	1048	1,070	15,700	8·60	18·20	135,000
Aug. 20.....	"	1048	840	10,200	6·40	12·75	65,500
Sept. 14.....	"	1055	825	7,570	4·80	9·20	36,400
Oct. 9.....	"	1055	710	6,230	3·10	7·30	[2]19,700
1913.							
May 5.....	"	1048	705	5,040	2·40	5·60	[3]12,300
May 26.....	"	1048	840	10,100	6·02	12·82	61,800
June 7.....	"	1048	1,055	13,400	7·60	16·30	102,000
Sept. 17.....	"	1048	825	7,340	4·33	9·20	31,800

[1] Ice conditions. [2] Various widths. [3] Include piers.

Monthly Discharge of Columbia river near Revelstoke for 1913.

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April.....	21,800	8,090*	12,247	1·36	1·51	726,000
May.....	94,500	12,300	36,500	4·05	4·67	2,240,000
June.....	148,000	83,600	109,900	12·21	13·62	6,490,000
July.....	109,000	61,100	84,400	9·38	10·81	5,190,000
August.....	95,800	47,300	73,000	8·11	9·35	4,490,000
September.....	71,100	23,400	39,400	4·38	4·89	2,340,000
October.....	24,000	13,000	17,209	1·91	2·20	1,060,000
November..	13,000	9,860	11,209	1·24	1·38	666,000

Note.—*Minimum discharge in second-feet for April is estimated.

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Daily Gauge Heights and Discharges of Columbia river near Revelstoke, for 1913.

Days.	April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			6·0	13,800	16·2	101,000
2			5·9	13,400	16·7	107,000
3			5·9	13,400	17·3	115,000
4			5·8	13,000	16·6	106,000
5			5·7	12,700	16·4	104,000
6			5·6	12,300	16·3	102,000
7			5·8	13,000	16·3	102,000
8			5·9	13,400	17·3	115,000
9			5·9	13,400	18·0	125,000
10			7·6	21,800	19·1	142,000
11			7·9	23,400	19·5	148,000
12			8·2	25,200	19·5	148,000
13			8·4	26,400	19·3	145,000
14	4·1	8,510	8·6	27,600	18·8	137,000
15	4·5	9,400	8·4	26,400	17·7	121,000
16	4·6	9,630	8·4	26,400	16·6	106,000
17	5·0	10,600	8·3	25,800	15·4	104,000
18	5·6	12,300	8·4	26,400	14·8	83,600
19	6·6	16,500	8·6	27,600	17·6	119,000
20	7·0	18,500	9·3	32,600	16·5	105,000
21	7·4	20,600	9·8	36,300	16·2	101,000
22	7·6	21,800	10·8	44,000	16·1	99,700
23	7·4	20,600	11·1	46,400	16·0	98,400
24	7·1	19,000	11·4	49,100	16·0	98,400
25	6·8	17,500	12·4	58,300	15·8	95,800
26	6·6	16,500	12·9	63,000	15·6	93,200
27	6·6	16,500	13·7	71,100	15·4	90,800
28	6·4	15,500	14·6	81,200	15·3	89,600
29	6·2	14,600	15·2	88,400	15·8	95,800
30	6·1	14,200	15·6	93,200	16·0	98,400
31			15·7	94,500		

DAILY GAUGE HEIGHTS AND DISCHARGES of Columbia river near Revelstoke for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	16·5	105,000	13·9	73,200	13·3	67,000	7·8	22,900	5·8	13,000
2	16·3	98,400	15·0	86,000	13·1	65,000	7·9	23,400	5·7	12,700
3	15·0	86,000	15·6	93,200	11·0	45,600	7·9	23,400	5·6	12,300
4	14·6	81,200	15·8	95,800	13·3	67,000	7·8	22,900	5·6	12,300
5	14·3	77,700	15·7	94,500	13·7	71,100	7·3	20,100	5·6	12,300
6	15·3	89,600	15·4	90,800	13·0	64,000	6·9	18,000	5·5	12,000
7	15·5	92,000	15·0	86,000	11·5	50,000	6·3	15,100	5·5	12,000
8	15·3	89,600	14·8	83,600	10·8	44,000	6·1	14,200	5·6	12,300
9	14·8	83,600	14·5	80,000	11·1	46,400	6·4	15,500	5·6	12,300
10	14·6	81,200	14·3	77,700	10·9	44,800	6·3	15,100	5·5	12,000
11	14·3	77,700	14·7	82,400	10·4	40,800	6·4	15,500	5·4	11,700
12	14·2	76,500	14·8	83,600	9·9	37,000	6·4	15,500	5·4	11,700
13	13·9	73,200	15·0	86,000	9·9	37,000	8·0	24,000	5·2	11,100
14	13·6	70,000	14·7	82,400	10·2	39,300	7·8	22,900	5·3	11,400
15	13·4	68,000	14·3	77,700	9·8	36,300	7·0	18,500	5·2	11,100
16	13·0	64,000	13·8	72,100	9·6	34,800	6·8	17,500	5·3	11,400
17	12·7	61,100	13·1	65,000	9·2	31,800	6·8	17,500	5·2	11,100
18	12·5	59,200	12·1	55,500	10·0	37,800	6·3	15,100	4·9	10,400
19	13·6	70,000	11·9	53,700	9·6	34,800	6·3	15,100	4·9	10,400
20	14·6	81,200	11·6	50,900	9·3	32,600	6·4	15,500	4·9	10,400
21	15·6	93,200	11·2	47,300	8·7	28,300	6·3	15,100	4·8	10,100
22	16·4	104,000	11·4	49,100	9·0	30,400	6·4	15,500	4·8	10,100
23	16·5	105,000	12·2	56,400	8·6	27,600	6·4	15,500	4·8	10,100
24	16·6	106,000	12·9	63,000	8·2	25,200	6·3	15,100	4·7	9,860
25	16·8	109,000	13·1	65,000	8·0	24,000	7·0	18,500	4·8	10,100
26	16·4	104,000	13·2	66,000	8·0	24,000	6·6	16,500	4·8	10,100
27	15·7	94,500	13·3	67,000	7·9	23,400	6·3	15,100	5·0	10,600
28	15·3	89,600	13·1	65,000	8·2	25,200	6·2	14,600	5·0	10,600
29	15·1	87,200	13·4	68,000	8·1	24,600	6·1	14,200	4·9	10,400
30	13·8	72,100	13·4	68,000	7·9	23,400	5·9	13,400	4·9	10,400
31	13·2	66,000	13·2	66,000	.....	.....	5·8	13,000	.....	.....

COLUMBIA RIVER NEAR CASTLEGAR.

Location.—Castlegar precinct, Nelson Water District, below Arrow lakes and above mouth of Kootenay river, at the C.P.R. bridge near Castlegar, B.C.

Winter Conditions.—The snowfall is fairly heavy; the thermometer seldom goes below zero; the river never freezes over at this section.

Gauge.—Vertical staff gauge referred to three bench-marks, and read daily by Mr. P. G. Farmer, of Castlegar, B.C.

Channel.—Straight for 200 yards above and below the measuring section and gauge. A pronounced riffle in low water is lost during high water. The rise and fall of the river is about 25 feet.

Discharge Measurements.—Measurements are made from the upstream side of the railway bridge. Four well-distributed measurements were made during 1913, by provincial district engineer, Water Rights Branch, and one by the British Columbia Hydrographic Surveys.

Accuracy.—The gauge readings from February 1, 1913, are very reliable. The discharge measurements are well distributed, and the 1913 gauge-height-discharge curve appears good. The Kootenay river flows in 1 mile below the gauge, and it appears that the fall in this mile is only about 6 feet. This tends to show that an effect of backwater is unavoidable. Results are within 10 per cent.

General.—This station on the Columbia was established by Provincial Engineer, Water Rights Branch, Nelson, in the beginning of 1913, and taken over by the British Columbia Hydrographic surveys in October, 1913. The drainage area is about 15,000 square miles, as compared with about 10,000 at our next station above at Revelstoke. This station forms a check on Kootenay river station near mouth and Columbia at Trail which is only a few miles below. Kootenay river plus Columbia river at Castlegar should equal Columbia river at Trail. For the months in 1913, in which we had gauge readings on all these streams July to December the sum of the mean monthly discharges at the first two stations equalled to within 10 per cent the corresponding mean monthly discharges at Trail. The rise and fall of the river at this station is practically the rise and fall of Lower Arrow lake

Discharge Measurements of Columbia River near Castlegar, B.C. for 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
June 14	W. G. L. & A. J. V.			20,100	7·88	28·2	158,500
July 5	do do			16,550	6·94	21·6	[1]114,850
" 22	do do			13,800	6·24	16·4	86,150
Sept. 5	do do			12,180	5·55	13·0	67,650
Nov. 25	C. E. R. & A. J. V.	1,527	440	7,730	2·04	3·2	15,800
1914.							
Jan. 14	C. E. W. & A. J. V.	1,048	380	6,800	1·66	1·7	11,300

Note.—From Provincial Water Rights Engineer, Biker.

Monthly Discharge of Columbia River near Castlegar, B.C., for 1913.

(Drainage area, 15,000 square miles.)

Month.	Discharge in Second-Feet.			Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
*January	13,900	11,200	12,500	0·83	0·96	769,000
February	8,600	6,600	7,810	0·52	0·54	433,000
March	6,900	6,600	6,660	0·44	0·51	409,000
April	24,000	6,200	11,400	0·76	0·85	678,000
May	88,800	24,500	41,000	0·73	3·15	2,520,000
June	160,000	98,000	136,000	9·09	10·1	8,100,000
July	123,000	86,100	101,000	6·71	7·74	6,200,000
August	88,800	63,300	78,800	5·25	60·5	4,850,000
September	68,800	42,700	56,900	3·79	4·23	3,390,000
October	41,000	25,500	30,900	2·06	2·38	1,900,000
November	25,500	15,800	20,000	1·33	1·48	1,190,000
December	15,300	9,200	12,600	0·84	0·97	775,000
The year	160,000	6,200	43,000	2·86	38·99	31,214,000

Note.—Columbia near Castlegar is immediately above mouth of Kootenay.

*Gauge heights were obtained from Provincial Water Rights Branch and it appears that the January readings are from a gauge with a different datum

Daily Gauge Heights and Discharges of Columbia River near Castlegar, B.C. for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·55	13,900	1·25	8,600	0·6	6,900	0·3	6,200	4·9	24,500	18·5	98,000
2	2·5	13,700	1·25	8,600	0·6	6,900	0·3	6,200	4·9	24,500	19·0	101,000
3	2·5	13,700	1·25	8,600	0·6	6,900	0·3	6,200	5·0	25,000	20·7	112,000
4	2·5	13,700	1·25	8,600	0·6	6,900	0·4	6,400	5·1	25,500	21·5	116,000
5	2·5	13,700	1·25	8,600	0·6	6,900	0·4	6,400	5·1	25,500	22·5	122,000
6	2·45	13,400	1·25	8,600	0·6	6,900	0·5	6,600	5·1	25,500	23·3	127,000
7	2·40	13,200	1·25	8,600	0·6	6,900	0·5	6,600	5·1	25,500	.....	130,000
8	2·40	13,200	1·2	8,400	0·6	6,900	0·5	6,600	5·2	26,000	.....	133,000
9	2·35	13,000	1·2	8,400	0·6	6,900	0·5	6,600	5·2	26,000	.....	136,000
10	2·35	13,000	1·2	8,100	0·6	6,900	0·6	6,900	5·5	27,500	.....	140,000
11	2·35	13,000	1·2	8,400	0·6	6,900	0·7	7,100	5·7	28,500	.....	144,000
12	2·35	13,000	1·2	8,400	0·6	6,900	0·9	7,500	6·0	30,000	.....	148,000
13	2·25	12,600	1·2	8,400	0·6	6,900	1·0	7,800	6·3	31,500	.....	152,000
14	2·25	12,600	1·2	8,400	0·6	6,900	1·3	8,800	6·4	32,000	28·2	156,000
15	2·25	12,600	1·0	7,800	0·5	6,600	1·6	10,000	6·8	34,000	28·8	160,000
16	2·15	12,200	1·0	7,800	0·5	6,600	1·9	11,200	7·1	35,500	.....	158,000
17	2·15	12,200	0·95	7,650	0·5	6,600	2·0	11,600	7·3	35,500	.....	156,000
18	2·15	12,200	0·95	7,650	0·5	6,600	1·8	10,800	7·6	38,000	.....	154,000
19	2·10	12,000	0·80	7,300	0·5	6,600	1·9	11,200	7·7	38,500	.....	152,000
20	2·10	12,000	0·75	7,200	0·5	6,600	2·0	11,600	7·9	39,500	.....	150,000
21	2·10	12,000	0·70	7,100	0·4	6,400	2·1	12,000	8·1	40,500	.....	148,000
22	2·10	12,000	0·60	6,900	0·4	6,400	2·4	13,200	8·7	43,800	.....	145,000
23	2·0	11,600	0·69	6,900	0·4	6,400	2·6	14,100	9·1	45,900	.....	142,000
24	2·0	11,600	0·55	6,750	0·4	6,400	2·9	15,300	9·9	50,200	.....	139,000
25	2·0	11,600	0·55	6,750	0·4	6,400	3·2	16,600	10·6	54,000	.....	136,000
26	2·0	11,600	0·55	6,750	0·4	6,400	3·8	19,300	11·2	57,300	.....	133,000
27	2·0	11,600	0·50	6,600	0·4	6,400	4·1	20,700	12·3	63,300	.....	130,000
28	1·95	11,400	0·50	6,600	0·4	6,400	4·4	22,100	13·4	69,400	.....	127,000
29	1·95	11,400	.....	.....	0·4	6,400	4·6	23,100	14·9	77,600	.....	124,000
30	1·95	11,400	.....	.....	0·4	6,400	4·8	24,000	15·7	82,500	.....	124,000
31	1·90	11,200	.....	.....	0·3	6,200	.....	.....	16·9	88,800	.....	.....

DAILY GAUGE HEIGHTS AND DISCHARGES of Columbia River for Castlegar, B. C., for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft	Feet.	Sec.-ft.
1	22·6	123,000	16·9	88,800	12·1	62,200	8·2	41,100	5·1	25,500	2·9	15,300
2	22·4	122,000	16·8	88,800	12·3	63,300	7·9	39,500	5·0	25,000	2·9	15,300
3	22·0	119,000	16·8	88,300	12·5	64,400	7·8	39,000	4·9	24,500	2·9	15,300
4	21·8	118,000	16·8	88,300	12·7	65,500	7·6	38,000	4·8	24,000	2·9	15,300
5	21·4	115,000	16·7	87,700	13·0	67,200	7·4	37,000	4·7	23,500	2·9	15,300
6	21·0	113,000	16·7	87,700	13·2	68,300	7·2	36,000	4·7	23,500	2·8	14,900
7	20·6	111,000	16·7	87,700	13·3	68,800	7·0	35,000	4·6	23,100	2·8	14,900
8	20·4	110,000	16·8	88,300	13·2	68,300	6·9	34,500	4·5	22,600	2·8	14,900
9	20·4	110,000	16·8	88,300	13·1	67,700	6·7	33,500	4·3	21,600	2·7	14,500
10	20·2	108,000	16·8	88,300	12·9	66,600	6·5	32,500	4·2	21,200	2·7	14,500
11	19·9	106,000	16·8	88,300	12·7	65,500	6·4	32,000	4·0	20,200	2·7	14,500
12	19·8	106,000	16·6	87,200	12·4	63,900	6·3	31,500	4·0	20,200	2·5	13,700
13	19·6	105,000	16·4	86,100	12·2	62,800	6·1	30,500	4·0	20,200	2·5	13,700
14	19·0	101,000	16·4	86,100	12·0	61,700	6·0	30,000	4·0	20,200	2·4	13,200
15	18·8	99,800	16·0	83,800	11·8	60,600	5·9	29,500	3·9	19,700	2·3	12,800
16	18·4	97,500	15·7	82,100	11·6	59,500	5·8	29,000	3·9	19,700	2·3	12,800
17	17·6	92,900	15·4	80,500	11·2	57,300	5·8	29,000	3·8	19,300	2·2	12,400
18	17·3	91,100	15·2	79,300	10·6	54,000	5·8	29,000	3·8	19,300	2·1	12,000
19	17·0	89,400	14·8	77,100	10·0	50,800	5·7	28,500	3·8	19,300	2·1	12,000
20	16·7	87,700	14·4	74,900	9·8	49,700	5·7	28,500	3·7	18,800	2·0	11,600
21	16·4	86,100	14·0	72,700	9·7	49,100	5·6	28,000	3·5	18,000	2·0	11,600
22	16·4	86,100	13·6	70,500	9·7	49,100	5·6	28,000	3·4	17,500	1·9	11,200
23	16·6	87,200	13·3	68,800	9·5	48,100	5·5	27,500	3·4	17,500	1·8	10,800
24	17·0	89,400	13·1	67,700	9·3	47,000	5·4	27,000	3·3	17,100	1·7	10,400
25	17·3	91,100	12·8	66,100	9·1	45,900	5·4	27,000	3·25	16,800	1·6	10,000
26	17·5	92,300	12·8	66,100	9·1	45,900	5·4	27,000	3·2	16,600	1·6	10,000
27	17·6	92,900	12·8	66,100	9·0	45,400	5·3	26,500	3·1	16,200	1·6	10,000
28	17·7	93,400	12·6	65,000	8·6	43,200	5·2	26,000	3·1	16,200	1·6	10,000
29	17·7	93,400	12·6	65,000	8·7	43,800	5·2	26,000	3·1	16,200	1·5	9,600
30	17·5	92,300	12·5	64,400	8·5	42,700	5·2	26,000	3·0	15,800	1·4	9,200
31	17·3	91,100	12·3	63,300	.....	.....	5·1	25,500	.....	.....	1·4	9,200

COLUMBIA RIVER NEAR TRAIL, ROSSLAND PRECINCT, NELSON WATER DISTRICT.

Location.—Fifteen miles above international boundary, above mouth of Pend d' Oreille river, below mouth of Kootenay at the highway bridge near Trail, B.C.

Records Available.—May to December, 1913.

Winter Conditions.—Fairly heavy snowfall. No continuous cold weather, though for a day or two the thermometer may reach (−15° F.) The river never freezes over.

Gauge.—Gauge painted on bridge pier was used till June, when it was abandoned and a chain gauge was installed. Mr. C. A. Brodwick, of Trail, B.C., reads the gauge daily.

Channel.—The river winds from the left (looking downstream) about 100 yards above the bridge; below the river is straight for 400 yards; the control, a pronounced riffle 100 yards below the bridge, appears permanent.

Discharge Measurements.—Measurements are made from the upstream side of the traffic bridge. Thirteen well distributed measurements have been made.

Accuracy.—Accurate gauge readings have been obtained. Reliable measurements were made throughout the year. The gauge-height-discharge curve appears to be very good. The results should be within 5 per cent.

General.—The station on the Columbia river at Trail was established in 1912 under the direction of Mr. Gray Donald. During 1913 it was maintained conjointly by the British Columbia Hydrographic Surveys and the provincial district engineer, Water Rights Branch, Nelson. Conditions appear permanent at this station, and satisfactory results should be obtained.

This station is very important. It is the chief factor from which the discharge of the Columbia into the United States may be obtained. Pend d' Oreille river is the only tributary of any consequence between this station and the International boundary.

The sum of the discharges of the Columbia at Trail, and the Pend d' Oreille should give the discharge of the Columbia into the United States to within 1 per cent. No gauging station has been established on the Columbia in the United States near the boundary, and it is not probable that any can be established without a large outlay, above Kettle Falls. The discharge at the international boundary does not appear to be more than 5 per cent less than the discharge at the Kettle Falls where, it may here be added, is the possible site of a large power development.

The drainage area of the Columbia at Trail is about 34,000 square miles. Below Arrow Lakes, some 25 miles above this station, the Columbia river never freezes, while above the lakes, ice conditions exist for generally four months in the year. The whole drainage area above this station is a very mountainous country, with heavy snowfall. The tributaries of the Columbia are generally glacial fed, and any year may see extremely high water, if in June we have a series of hot days and nights. The variation between maximum and minimum flow is great. In 1913 the maximum recorded discharge was 297,000 c.f.s., and the minimum recorded discharge was in March, when it was as low as 1,4000 c.f.s.

DISCHARGE MEASUREMENTS of Columbia river near Trail, B.C., for 1912-13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Dec. 18	Wilson	.....	480	6,640	2·79	10·50	18,600
1913.							
Nov. 5	Wilson	.....	460	5,640	2·53	8·50	14,300
Mar. 26	Wilson	.....	460	5,640	2·72	8·50	[1]15,400
May 1	C. E. R. & Biker	1,048	515	9,360	6·30	15·40	58,700
May 21	Biker & Lowley	1,527	532	11,200	7·30	19·00	[2]82,200
June 11	C. E. R. Biker and party	1,048	687	23,900	12·40	40·20	297,000
July 4	Lowley & Venables	1,527	663	20,100	10·90	34·50	219,000
July 21	do do	1,527	580	15,800	9·63	27·60	152,000
Aug. 6	do do	1,527	583	15,100	9·42	26·10	142,000
" 7	C. E. R. & J. A. E.	1,048	583	15,100	9·65	26·10	145,000
Sept. 4	Lowley & Venables	1,527	547	12,300	7·93	21·00	97,000
Nov. 5	C. E. R. & C. E. W.	1,048	509	7,630	4·86	13·10	37,100
1914.							
Jan. 15	Venables & Webb	1,048	485	6,250	3·57	9·50	[3]22,300

NOTE.—[1]Strong wind downstream.
[2]Not a reliable measurement.
[3]New gauge was established August 7, when both gauges read 26' 10". On November 5 old gauge read 12' 6" while new gauge read 13' 6". Difference caused by water piling up beside pier to which old gauge was fastened, during high water.

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Monthly Discharge of Columbia river near Trail, B.C., for 1913.

(Drainage area, 84,000 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	165,000	56,800	86,400	2·54	2·93	5,310,000
June	312,000	191,000	262,000	7·70	8·59	15,600,000
July	236,000	150,000	181,000	5·32	6·13	11,100,000
August	152,000	98,400	125,000	3·68	4·24	7,690,000
September	98,400	62,100	83,500	2·46	2·75	4,970,000
October	60,500	39,300	46,900	1·38	1·59	2,880,000
November	39,300	27,800	32,200	0·95	1·06	1,920,000
December	27,800	18,600	22,600	0·66	0·76	1,390,000

Note.—Columbia river near Trail is immediately below the mouth of the Kootenay.

Daily Gauge Heights and Discharges of Columbia river near Trail for 1913.

Day.	April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	16·2	58,200	31·5	191,000
2	.....	.....	16·1	57,500	32·6	202,000
3	.....	.....	16·1	57,500	33·7	214,000
4	.....	.....	16·1	57,500	34·8	226,000
5	.....	.....	16·0	56,800	35·9	239,000
6	.....	.....	16·0	56,800	36·7	248,000
7	.....	.....	16·0	56,800	37·5	258,000
8	.....	.....	16·2	58,200	37·5	258,000
9	.....	.....	16·6	61,300	37·3	256,000
10	.....	.....	16·9	63,700	39·2	279,000
11	.....	.....	17·2	66,000	40·0	290,000
12	.....	.....	17·5	68,300	40·4	295,000
13	.....	.....	17·9	71,400	41·3	308,000
14	.....	.....	18·1	73,000	41·6	312,000
15	.....	.....	18·5	76,000	41·6	312,000
16	.....	.....	18·7	77,600	41·2	306,000
17	.....	.....	19·3	82,400	40·6	298,000
18	11·8	28,800	19·7	85,600	40·1	291,000
19	12·0	30,000	19·8	86,400	39·4	282,000
20	12·1	30,600	19·9	87,200	38·8	274,000
21	12·5	33,000	20·0	88,000	38·2	266,000
22	13·0	36,000	20·2	89,600	37·6	259,000
23	14·1	43,500	20·6	92,800	37·1	253,000
24	14·1	43,500	21·2	97,600	37·0	252,000
25	14·4	45,600	22·3	16,670	36·8	250,000
26	14·8	48,400	23·4	116,600	36·8	250,000
27	15·2	51,200	24·5	126,500	36·6	247,000
28	15·5	53,300	25·8	137,400	36·5	246,000
29	15·7	54,700	26·8	146,200	36·3	244,000
30	16·0	56,800	27·7	154,300	36·1	241,000
31	.....	.....	28·9	165,100	.....	.....

DAILY GAUGE HEIGHTS AND DISCHARGES of Columbia river near Trail for 1913.
—*Continued.*

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	35·7	236,000	27·5	152,500	21·2	97,600	16·5	60,500	13·5	39,300	11·6	27,800
2	35·3	232,000	27·2	149,800	21·1	96,800	16·4	59,700	13·4	38,600	11·5	27,500
3	34·9	227,000	26·9	147,100	21·1	96,800	16·1	57,500	13·2	37,200	11·4	26,800
4	34·5	222,200	26·6	144,400	21·0	96,000	15·9	56,100	13·2	37,200	11·3	26,300
5	34·0	217,000	26·3	141,700	21·0	96,000	15·7	54,700	13·1	36,600	11·3	26,300
6	33·6	213,000	26·0	139,000	21·2	97,600	15·5	53,300	13·0	36,000	11·3	26,300
7	32·8	204,000	26·1	139,900	21·3	98,400	15·4	52,600	13·0	36,000	11·2	25,800
8	32·4	200,000	26·1	139,900	21·3	98,400	15·2	51,200	12·9	35,400	11·1	25,300
9	32·0	196,000	26·0	139,000	21·4	98,400	15·0	49,800	12·8	34,800	11·0	24,800
10	31·7	193,000	25·9	138,200	21·2	97,600	14·8	48,400	12·8	34,800	10·9	24,300
11	31·6	192,000	25·8	137,400	21·1	96,800	14·7	47,700	12·7	34,200	10·8	23,800
12	31·5	191,000	25·8	137,400	20·8	94,400	14·6	47,000	12·7	34,200	10·7	23,300
13	31·3	189,000	25·7	136,600	20·4	91,200	14·5	46,300	12·6	33,600	10·6	22,800
14	30·8	184,000	25·5	135,000	20·1	88,800	14·3	44,900	12·4	32,400	10·5	22,300
15	30·3	179,000	25·2	132,600	19·8	86,400	14·2	44,200	12·3	31,800	10·4	21,800
16	29·8	174,000	25·0	131,000	19·4	83,200	14·1	43,500	12·2	31,200	10·4	21,800
17	29·4	170,000	24·8	129,200	19·0	80,000	14·8	48,400	12·0	30,000	10·4	21,800
18	28·8	164,200	24·4	125,600	18·9	79,200	14·4	45,600	11·9	24,400	10·3	21,300
19	28·4	160,600	23·9	121,100	18·7	77,600	14·3	44,900	11·8	28,800	10·3	21,300
20	28·0	157,000	23·4	116,600	18·5	76,000	14·2	44,200	11·7	28,300	10·2	20,900
21	27·6	153,400	22·8	111,200	18·3	74,500	14·1	43,500	11·6	27,800	10·2	20,900
22	27·2	149,800	22·7	110,300	18·2	73,700	14·0	42,800	11·7	28,300	10·2	20,900
23	27·2	149,800	22·3	106,700	18·0	72,200	14·0	42,800	11·8	28,800	10·1	20,400
24	27·7	154,300	21·8	102,400	17·7	69,800	13·9	42,100	11·8	28,800	10·1	20,400
25	27·9	156,100	21·6	100,800	17·4	67,500	13·8	41,400	11·8	28,800	10·0	20,000
26	28·3	159,700	21·6	100,800	17·3	66,800	13·8	41,400	11·8	28,800	10·0	20,000
27	28·6	162,400	21·4	99,200	17·1	65,300	13·7	40,700	11·8	28,800	9·9	19,500
28	28·5	161,500	21·5	100,000	16·9	63,700	13·7	40,700	11·7	28,300	9·9	19,500
29	28·2	158,800	21·5	100,000	16·8	62,900	13·6	40,000	11·7	28,300	9·8	19,000
30	27·8	155,200	21·5	100,000	16·7	62,100	13·6	40,000	11·7	28,300	9·8	19,000
31	27·6	153,400	21·3	98,400	.....	.....	13·5	39,300	.....	.....	9·7	18,600

HORSETHIEF CREEK.

Location.—On the east slope of the Selkirk mountains, on the traffic bridge 4 miles from Wilmer and 1 mile from the mouth.

Records Available.—June to October, 1912; May to September, 1913; Ice measurement on November 27, 1913; discharge, 147.

Gauge.—Vertical staff gauge referred to three bench-marks, nailed to one bridge abutment. Capt. Ch. de Crespigny reads the gauge three times a week.

Channel.—The measuring section is not a desirable one. The control does not appear permanent, and there may be a backwater effect from the Columbia. Accurate measurements may not be obtained.

Discharge Measurements.—Meterings are taken from the bridge, four measurements were made in 1912, and nine in 1913.

Accuracy.—The gauge readings are infrequent, the discharge measurements unreliable, and the gauge-height-discharge curves for 1912-13 do not appear satisfactory, nor do they agree. Accuracy not guaranteed to within 25 per cent.

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Discharge Measurements of Horsethief Creek, near Wilmer, B.C., for 1912-13

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge
1912.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec. ft.
May 29	H. C. Hughes	1055	68	129	3·75	1·70	484
June 13	do	1055	97	222	5·31	2·00	1,180
July 3	do	1055	95	226	5·19	1·90	1,170
Sept. 28	C. E. Richardson	1055	61	119	2·12	1·22	252
1913.							
May. 16	C. E. R. & J. A. E.	1672	60	134	2·00	1·20	271
June 2	C. E. Richardson	1048	87	268	8·00	2·65	2,140
June 19	J. A. Elliott	1672	85	220	6·42	2·22	1,410
July 11	C. E. Richardson	1048	85	225	6·66	2·25	1,500
July 25	J. A. Elliott	1672	85	253	8·60	2·50	2,180
July 30	do	1672	83	200	5·67	2·00	1,130
Sept. 3	C. E. Richardson and R. G. Swan	1048	82	200	4·25	1·95	850
Sept. 13	J. A. Elliott	1672	77	186	4·12	1·88	770
Nov. 27	C. E. Webb	1048	55	98	1·50	.....	[1]147

Note.—[1]Gauge frozen in.

Monthly Discharge of Horsethief Creek at Mouth for 1913.

(Drainage area, 170 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	2,380	250	612	3·60	4·15	37,600
June	2,930	1,220	1,948	11·50	12·83	116,000
July	3,200	880	1,494	8·79	10·13	91,600
August	2,120	880	1,400	8·24	9·50	86,100
September	1,640	610	901	5·30	5·91	53,600

Daily Gauge Heights and Discharges of Horsethief Creek near Wilmer, B.C., for 1913.

(Drainage Area 170 square miles.)

Day.	May.		June.		July.		August.		September.	
	Gauge-Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
1			2·6	2,380	2·2	1,410	2·1	1,220	2·1	1,220
2			2·6	2,380	2·2	1,410	2·2	1,410	2·0	1,030
3			2·6	2,380	2·1	1,220	2·3	1,640	2·0	1,030
4			2·6	2,380	2·1	1,220	2·5	2,120	2·2	1,410
5			2·6	2,380	2·0	1,030	2·4	1,880	2·3	1,640
6			2·6	2,380	2·2	1,410	2·3	1,640	2·2	1,410
7			2·6	2,380	2·4	1,880	2·3	1,640	2·1	1,220
8			2·7	2,650	2·2	1,410	2·2	1,410	1·9	880
9			2·8	2,930	2·2	1,410	2·2	1,410	1·8	730
10			2·7	2,650	2·2	1,410	2·2	1,410	1·8	730
11			2·6	2,380	2·2	1,410	2·3	1,640	1·8	730
12			2·6	2,380	2·1	1,220	2·3	1,640	1·9	880
13			2·5	2,120	2·0	1,030	2·3	1,640	1·9	880
14			2·5	2,120	2·0	1,030	2·2	1,410	1·9	880
15			2·4	1,880	1·9	880	2·2	1,410	1·9	880
16	1·2	250	2·4	1,880	1·9	880	2·2	1,410	1·9	880
17	1·2	250	2·3	1,640	1·9	880	2·0	1,030	1·9	880
18	1·2	250	2·3	1,640	2·0	1,030	1·9	880	1·9	880
19	1·2	250	2·2	1,410	2·1	1,220	1·9	880	1·9	880
20	1·3	295	2·2	1,410	2·2	1,410	2·0	1,030	1·9	880
21	1·4	355	2·2	1,410	2·3	1,640	2·2	1,410	1·9	880
22	1·5	425	2·1	1,220	2·4	1,880	2·0	1,030	1·8	730
23	1·7	610	2·1	1,220	2·5	2,120	2·1	1,220	1·8	730
24	1·9	880	2·1	1,220	2·7	2,650	2·2	1,410	1·8	730
25	2·1	1,220	2·2	1,410	2·9	3,200	2·2	1,410	1·8	730
26	2·2	1,410	2·3	1,640	2·5	2,120	2·2	1,410	1·8	730
27	2·3	1,640	2·3	1,640	2·5	2,120	2·2	1,410	1·8	730
28	2·4	1,880	2·3	1,640	2·4	1,880	2·2	1,410	1·7	610
29	2·4	1,880	2·3	1,640	2·3	1,640	2·2	1,410	1·7	610
30	2·6	2,380	2·3	1,640	2·1	1,220	2·1	1,220	1·7	610
31	2·6	2,380	.....	.....	2·0	1,030	2·1	1,220	.....	.....

Mean G.H. for 15 days = 1·00

Discharge for 15 days = 2,625

ILLECILLEWAET RIVER NEAR REVELSTOKE, B.C.

Location.—This station is located within 1 mile of the city of Revelstoke, and 1 mile from the mouth of the river; the gauge is located on traffic bridge in S.W. $\frac{1}{4}$ section 26, township 23, range 2, west 6th meridian; the measuring section is located on traffic bridge in N.E. $\frac{1}{4}$ section 22, township 23, range 2, west 6th meridian.

Records Available.—October to December, 1911; May to December, 1912; April to November, 1913. Measurement made under ice conditions in February, 1912, gave a discharge of 197 c.f.s.

Gauge.—A chain gauge, referred to two bench-marks, is used and read by Miss S. Moran of Revelstoke.

Channel.—The measuring section is one-half mile below gauge. The section at the gauge is very fast in high water, and at the measuring section there is a possibility of backwater from the Columbia during high water, the control at the gauge appears permanent.

Discharge Measurements.—Eight well distributed measurements were made during 1911-12, and five were made in 1913.

Accuracy.—The gauge readings are accurate, and the stream is closely watched by an observer. The discharge measurements should be good, but the gauge-height-discharge curve is not first-class. Accuracy not guaranteed to greater degree than 10 per cent.

Winter Conditions.—See Columbia river near Revelstoke.

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Discharge Measurements of Illecillewaet River near Revelstoke for 1911-12-13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Oct. 13	C. E. Richardson	1,048	140	478	1·40	1·32	[1]669·0
1912.							
Feb. 24	do	1047	129	221	0·89	0·70	197
June 20	do	1048	144	890	7·43	6·60	6,610
June 24	do	1048	145	962	7·80	6·90	7,510
July 3	do	1048	142	735	5·57	5·60	4,100
Aug. 20	do	1048	133	583	3·98	4·40	2,320
Sept. 14	do	1048	128	514	3·40	3·82	1,750
Oct. 4	do	1055	128	498	2·16	3·00	1,080
1913.							
May 5	J. A. Elliott	1048	128	327	3·40	3·00	[2]1,110
May 26	do	1048	134	636	8·00	6·11	5,030
June 11	do	1672	145	878	6·92	6·55	6,080
Sept. 17	R. G. Swan	1048	101	660	3·36	3·90	[3]2,220
Nov. 22	C. E. Webb	1048	130	431	1·41	2·35	607

[1]Gauge abandoned.
[2]Slightly different section.
[3]Different section.

Monthly Discharge of Illecillewaet River near Revelstoke for 1913.

(Drainage area, 480 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April	2,110	300	1,190	2·5	2·79	70,800
May	6,560	934	2,845	5·9	6·80	175,000
June	11,880	3,740	6,173	12·8	14·28	364,000
July	10,300	3,310	5,134	10·7	12·34	316,000
August	8,970	1,890	3,803	7·9	9·11	234,000
September	11,800	1,240	2,302	4·8	5·36	137,000
October	1,590	606	1,094	2·3	2·65	67,000
November	1,010	606	748	1·6	1·79	44,500

Daily Gauge Heights and Discharges of Illecillewaet River near Revelstoke for 1913.

Day.	April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	3·0	1,080	6·7	6,560
2	.....	.....	3·0	1,080	6·9	7,340
3	.....	.....	2·9	1,010	7·0	7,800
4	.....	.....	2·9	1,010	6·8	6,920
5	.....	.....	2·8	934	6·4	5,700
6	1·7	347	2·8	934	6·3	5,450
7	1·7	347	2·8	934	6·5	5,950
8	1·5	300	3·4	1,410	7·0	7,800
9	1·9	410	3·8	1,790	7·6	11,800
10	1·9	410	4·6	2,670	7·7	11,880
11	2·1	497	4·6	2,670	7·0	7,800
12	2·6	796	4·6	2,670	7·0	7,800
13	3·0	1,080	4·5	2,550	7·1	8,410
14	3·3	1,320	4·5	2,550	6·8	6,920
15	3·3	1,320	4·4	2,440	6·1	5,010
16	3·4	1,410	4·2	2,220	5·8	4,410
17	3·3	1,320	4·1	2,110	5·5	3,900
18	3·5	1,500	4·0	2,000	5·4	3,740
19	3·9	1,890	4·0	2,000	6·0	4,800
20	3·9	1,890	4·0	2,000	6·8	6,920
21	4·1	2,110	4·4	2,440	6·3	5,450
22	4·0	2,000	4·6	2,670	6·0	4,800
23	3·8	1,790	5·6	4,060	6·0	4,800
24	3·4	1,410	5·7	4,234	5·9	4,600
25	3·3	1,320	5·9	4,600	5·8	4,410
26	3·3	1,320	6·2	5,220	6·0	4,800
27	3·3	1,320	6·2	5,220	6·0	4,800
28	3·2	1,240	6·6	6,230	6·0	4,800
29	3·2	1,240	6·2	5,220	6·0	4,800
30	3·1	1,160	6·4	5,700	6·1	5,010
31	.....	.....	6·7	6,560	.....	.....

DAILY GAUGE HEIGHTS AND DISCHARGES of Illecillewaet River near Revelstoke for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	6·6	6,230	5·9	4,600	3·8	1,790	3·2	1,240	2·9	1,010
2	6·6	6,230	6·1	5,010	4·5	2,550	3·6	1,590	2·9	1,010
3	5·6	4,060	6·2	5,220	4·5	2,550	3·2	1,240	2·9	1,010
4	5·5	3,900	5·9	4,600	7·6	11,800	3·1	1,160	2·9	1,010
5	5·6	4,060	6·0	4,800	5·8	4,410	3·0	1,080	2·7	864
6	6·6	6,230	6·1	5,010	4·5	2,550	2·8	934	2·7	864
7	6·8	6,920	6·5	5,950	4·3	2,330	2·8	934	2·6	796
8	6·0	4,800	7·2	8,970	4·3	2,330	2·8	934	2·5	730
9	6·7	6,560	5·8	4,410	4·3	2,330	2·8	934	2·4	667
10	6·5	5,950	5·6	4,060	3·9	1,890	2·5	730	2·4	667
11	6·2	5,220	5·8	4,410	3·8	1,790	2·3	606	2·4	667
12	5·4	3,740	5·7	4,234	4·0	2,000	2·6	796	2·4	667
13	5·4	3,740	5·7	4,234	4·6	2,670	3·5	1,500	2·4	667
14	7·4	10,300	5·4	3,740	4·1	2,110	3·6	1,590	2·4	667
15	6·5	5,950	4·8	2,910	3·9	1,890	3·3	1,320	2·4	667
16	5·7	4,234	4·4	2,440	3·9	1,890	3·1	1,160	2·4	667
17	5·2	3,450	4·8	2,910	3·8	1,790	3·0	1,080	2·4	667
18	5·3	3,590	4·6	2,670	4·3	2,330	2·9	1,010	2·4	667
19	5·7	4,234	4·3	2,330	4·0	2,000	2·9	1,010	2·4	667
20	6·4	5,700	4·0	2,000	3·6	1,590	2·9	1,010	2·3	606
21	6·5	5,950	4·0	2,000	3·6	1,590	3·0	1,080	2·3	606
22	6·6	6,230	4·4	2,440	3·5	1,500	2·8	934	2·3	606
23	6·2	5,220	4·7	2,790	3·5	1,500	3·0	1,080	.....	.....
24	6·5	5,950	5·0	3,170	3·5	1,500	2·9	1,010	.....	.....
25	6·4	5,700	4·8	2,710	3·2	1,240	3·2	1,240	.....	.....
26	6·2	5,220	5·7	4,234	3·3	1,320	3·1	1,160	.....	.....
27	5·9	4,600	5·7	4,234	3·4	1,410	3·1	1,160	.....	.....
28	6·0	4,800	5·2	3,450	3·5	1,500	3·1	1,160	.....	.....
29	5·1	3,310	5·0	3,170	3·5	1,500	3·0	1,080	.....	.....
30	5·2	3,450	5·1	3,310	3·4	1,410	3·0	1,080	.....	.....
31	5·5	3,900	3·9	1,890	.....	.....	3·0	1,080	.....	.....

ILLECILLEWAET RIVER AT GLACIER.

Location.—In township 26, range 26, west 5th meridian, at the foot-bridge immediately above the railway bridge, 200 yards from C.P.R. hotel, Glacier.

Records Available.—June to December, 1913.

Winter Conditions.—Severe (-40° F.) with very heavy snowfall—between 40 and 50 feet. Gauge readings are generally affected by ice conditions from November to April.

Gauge.—A vertical staff gauge is used and read by H. T. Hillyer, Glacier, B.C.

Channel.—The bed is rocky and during freshet the water is very swift, the control appears permanent.

Discharge Measurements.—Twelve well distributed measurements were made during 1913.

Accuracy.—Accurate measurements were not obtained. The river is very flashy and the gauge readings obtained cannot be guaranteed to be the mean for the day. Accuracy 20 per cent.

General.—This station on the Illecillewaet is only $2\frac{1}{2}$ miles from the tongue of the Illecillewaet or Great Glacier. The C.P.R. have a small power plant immediately above the station from which they light their hotel during the summer. In extremely cold weather the stream probably drops to 10 c.f.s.

Discharge Measurements of Illecillewaet River near Glacier for 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 23	C. E. R.	1,048	35	22·0	3·90	0·98	85·8
June 4	do	1,048	37	55·4	5·70	1·80	316·0
June 5	do	1,048	37	39·0	4·80	1·40	187·0
June 13	J. A. E.	1,672	37	63·6	6·77	2·00	430·0
July 6	do	1,672	37	67·7	7·20	2·10	487·0
July 20	do	1,672	37	92·0	8·54	2·70	786·0
July 21	do	1,672	37	74·0	7·64	2·25	565·0
July 23	C. E. R.	1,048	37	92·0	7·77	2·70	715·0
July 23	do	1,048	37	100·0	8·43	2·90	843·0
Aug. 11	do	1,048	37	65·1	5·70	1·95	351·0
Sept. 10	R. G. S. & C. E. R.	1,048	37	33·8	2·56	0·68	86·4
Dec. 2	C. E. W.	1,048	34	18·8	1·30	0·20	25·1

Daily Gauge Heights and Discharges of Illecillewaet River near Glacier for 1913.

Month.	Discharge in Second-Feet.		
	Maximum.	Minimum.	Mean.
June	650	125	329
July	950	125	483
August	900	90	530
September	325	30	79
October	35	20	27
November	20	15	16
December	25	15	16

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Daily Gauge Heights and Discharges of Illecillewaet River near Glacier for 1913.

Day.	May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	1·8	325
2	.....	.....	2·0	410
3	.....	.....	2·0	410
4	.....	.....	1·9	365
5	.....	.....	1·6	245
6	.....	.....	1·7	285
7	.....	.....	2·0	410
8	.....	.....	2·5	650
9	.....	.....	2·5	650
10	.....	.....	2·2	500
11	.....	.....	2·0	410
12	.....	.....	2·1	455
13	.....	.....	2·0	410
14	.....	.....	1·5	215
15	.....	.....	1·3	165
16	.....	.....	1·2	145
17	.....	.....	1·1	125
18	.....	.....	1·7	285
19	.....	.....	2·5	650
20	.....	.....	1·8	325
21	.....	.....	1·5	215
22	.....	.....	1·7	285
23	1·0	105	1·7	285
24	1·0	105	1·5	215
25	1·2	145	1·5	215
26	1·4	190	1·5	215
27	1·4	190	1·4	195
28	1·4	190	1·6	245
29	1·3	165	1·6	245
30	1·3	165	1·8	325
31	1·7	285	.....	.....

DAILY GAUGE HEIGHTS AND DISCHARGES of Illecillewaet River near Glacier for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·0	410	2·9	850	1·0	105	0·4	35	0·1	20	0·1	20
2	1·7	285	2·9	850	0·9	90	6·4	35	0·1	20	0·2	25
3	1·6	245	2·9	850	1·8	375	0·3	30	0·1	20	0·2	25
4	1·6	245	2·9	850	1·5	215	0·3	30	0·0	15	0·1	20
5	1·8	325	3·0	900	0·9	90	0·3	30	0·0	15	0·0	15
6	2·1	455	2·6	700	0·8	75	0·3	30	0·0	15	0·0	15
7	2·2	500	2·7	750	0·8	75	0·3	30	0·0	15	0·0	15
8	2·2	500	2·3	550	0·8	75	0·2	25	0·0	15	0·0	15
9	2·0	410	2·3	550	0·6	55	0·2	25	0·0	15	0·0	15
10	2·4	410	2·6	700	0·7	65	0·2	25	0·0	15	0·0	15
11	1·7	285	2·5	650	0·7	65	0·4	35	0·0	15	0·0	15
12	1·7	285	2·7	750	0·8	75	0·5	30	0·0	15	0·0	15
13	1·7	285	2·5	650	1·0	105	0·3	30	0·0	15	0·0	15
14	1·1	125	1·5	215	0·9	90	0·2	25	0·0	15	0·0	15
15	1·2	145	1·3	165	0·8	75	0·2	25	0·0	15	0·0	15
16	1·1	125	1·3	165	0·8	75	0·2	25	0·0	15	0·0	15
17	1·4	190	1·2	145	1·0	105	0·2	25	0·0	15	0·2	15
18	1·8	325	0·9	90	0·9	90	0·2	25	0·0	15	0·0	15
19	2·4	600	0·9	90	0·8	75	0·2	25	0·0	15	0·0	15
20	2·9	850	1·4	190	0·8	75	0·2	25	0·0	15	0·0	15
21	3·0	900	1·4	190	0·8	75	0·2	25	0·0	15	0·0	15
22	3·1	950	2·3	550	0·4	35	0·2	25	0·0	15	0·0	15
23	3·0	900	2·6	700	0·4	35	0·2	25	0·0	15	0·0	15
24	3·0	900	2·6	700	0·4	35	0·2	25	0·0	15	0·0	15
25	2·8	800	2·5	550	0·3	30	0·2	25	0·0	15	0·0	15
26	2·8	800	2·3	550	0·3	30	0·2	25	0·0	15	0·0	15
27	2·7	750	2·3	550	0·3	30	0·2	25	0·0	15	0·0	15
28	2·4	600	2·3	550	0·4	35	0·2	25	0·0	15	0·0	15
29	1·8	325	2·2	500	0·4	35	0·1	20	0·0	15	0·0	15
30	1·4	190	2·2	500	0·4	35	0·1	20	0·1	20	0·0	15
31	2·9	850	1·8	325	.....	.....	0·1	20	.....	.....	0·0	15

Kicking Horse River looking upstream from Natural Bridge.

KICKING HORSE RIVER NEAR GOLDEN.

Location.—In N.E. $\frac{1}{4}$ section 12, township 27, range 22, west 5th meridian, on traffic bridge in the town of Golden.

Records Available.—April to October, 1912; April to November, 1913. One metering was taken under ice conditions in February, 1912; discharge, 172 c.f.s.

One metering was taken under ice conditions in February, 1914; discharge 276 c.f.s.

Winter Conditions.—Severe (40° F.), with heavy snowfall. Ice conditions generally exist from November to April. Frazil ice.

Gauge.—A vertical staff gauge is used and read two or three times daily by Mr. W. Wenman of Golden, B.C.

Channel.—Straight for 200 yards above and below the station. Control is a sandbar about 100 yards downstream from section.

Discharge Measurements.—Measurements are made from bridge, ten being made in 1911-12, and five in 1913.

Accuracy.—Gauge readings are very accurate, the gauge being read as many as six times a day during high water. Measurements appear accurate and gauge-height-discharge curves are very good. Results guaranteed to be within 5 per cent, except in May and June, when there may be an error of 15 per cent.

Discharge Measurements of Kicking Horse River near Golden for 1911-12-13.

Date.	Hydrographer.	Meter No.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1911.							
Oct. 18	C. E. Richardson	1,048	103	279	1·66	1·72	464
1912.							
Feb. 22	do	1,048	80	185	0·93	.....	172[1]
May 24	H. C. Hughes	1,055	119	430	4·28	3·46	1,840
June 4	do	1,055	110	372	2·68	2·64	999
June 8	do	1,048	155	567	4·21	3·90	2,390[2]
June 24	do	1,055	205	928	6·42	5·58	5,970[2]
July 12	do	1,055	185	654	5·19	4·62	3,340[2]
July 26	do	1,055	180	604	4·69	4·26	2,830[2]
Sept. 26	do	1,055	110	363	2·85	2·48	1,035
Oct. 1	do	1,055	110	351	2·65	2·36	930
1913.							
May 22	J. A. Elliott	1,672	112	431	3·67	2·97	1,540
July 5	do	1,048	185	654	5·60	4·52	3,660
July 5	do	1,672	185	654	5·50	4·52	3,580
Sept. 4	R. G. Swan	1,048	186	712	6·47	4·90	4,610
Nov. 29	C. E. Webb	1,048	96	277	1·40	1·55	384

[1] Ice Conditions.
[2] Water flowing inside channel.

Monthly Discharge of Kicking Horse River near Golden for 1913.

(Drainage area, 700 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April	1,260	650	836	1·20	1·34	49,700
May	6,320	416	1,817	2·60	3·00	111,000
June	9,580	3,390	2,762	4·00	4·46	164,000
July	5,660	2,500	4,018	5·70	6·57	246,000
August	4,760	2,250	3,426	4·90	5·65	210,000
September	4,240	1,420	2,056	2·90	3·24	122,000
October	1,420	650	939	1·30	1·50	57,700
November	730	181	493	0·70	0·78	29,400

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Daily Gauge Heights and Discharges of Kicking Horse River near Golden for 1913.

Day.	April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			1·8	571	5·7	7,040
2			1·7	483	5·8	7,420
3			1·7	483	5·8	7,420
4			1·7	483	5·7	7,040
5			1·6	416	5·7	7,040
6			1·6	416	5·4	5,980
7			1·7	483	5·5	6,320
8			1·7	483	6·0	8,240
9			1·7	483	6·3	9,580
10			2·2	895	6·3	9,580
11			2·3	979	6·2	9,120
12			2·3	979	6·1	8,670
13			2·4	1,060	5·8	7,420
14			2·4	1,060	5·7	7,040
15	1·9	650	2·4	1,060	5·2	5,350
16	2·1	812	2·3	979	4·7	4,000
17	2·3	979	2·4	1,060	4·5	3,580
18	2·1	812	2·3	979	4·4	3,390
19	2·2	895	2·4	1,060	4·9	4,490
20	2·5	1,150	2·6	1,240	6·0	8,240
21	2·6	1,260	2·7	1,330	5·5	6,320
22	2·4	1,060	3·0	1,600	5·1	5,050
23	2·1	812	3·5	2,130	5·1	5,050
24	2·1	812	3·7	2,370	4·9	4,490
25	2·1	812	4·1	2,910	4·8	4,240
26	1·9	650	4·4	3,390	4·7	4,000
27	2·0	730	4·5	3,580	4·8	4,240
28	1·9	650	5·1	5,050	4·6	3,780
29	1·9	650	5·5	6,320	4·9	4,490
30	1·9	650	5·3	5,660	4·8	4,240
31	.....	.....	5·5	6,320	.....	.....

DAILY GAUGE HEIGHTS AND DISCHARGES of Kicking Horse River near Golden for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	5·2	5,350	4·5	3,580	3·8	2,500	2·8	1,420	1·9	650
2	5·1	5,050	4·8	4,240	3·3	1,900	2·8	1,420	1·9	650
3	4·8	4,240	4·7	4,000	3·2	1,790	2·8	1,420	1·8	571
4	4·6	3,780	4·7	4,000	4·7	4,000	2·6	1,240	1·9	650
5	4·4	3,390	4·6	3,780	4·8	4,240	2·5	1,150	2·0	730
6	4·3	3,220	4·8	4,240	4·3	3,220	2·5	1,150	1·9	650
7	5·3	5,660	4·6	3,780	3·9	2,690	2·3	969	1·9	650
8	4·8	4,240	5·0	4,760	3·7	2,370	2·3	979	1·8	571
9	4·8	4,240	4·7	4,000	3·9	2,690	2·2	895	1·8	571
10	4·9	4,490	4·7	4,000	3·7	2,370	2·2	895	1·8	571
11	4·8	4,240	4·5	3,580	3·5	2,130	2·2	895	1·8	571
12	4·5	3,580	4·8	4,240	3·4	2,010	2·3	979	1·8	571
13	4·4	3,390	5·0	4,760	3·5	2,130	2·4	1,060	1·6	416
14	4·2	3,060	4·6	3,780	3·4	2,010	2·4	1,060	1·5	340
15	4·0	2,770	4·3	3,220	3·2	1,790	2·3	979	1·5	340
16	3·8	2,500	4·0	2,770	3·2	1,790	2·3	979	1·8	571
17	3·8	2,500	4·0	2,770	3·1	1,690	2·2	895	1·8	571
18	4·0	2,770	4·5	3,580	3·4	2,010	2·2	895	1·6	416
19	4·3	3,220	3·8	2,500	3·3	1,900	2·1	812	1·5	340
20	4·7	4,000	3·7	2,370	3·1	1,690	2·1	812	1·5	340
21	5·0	4,760	3·6	2,250	3·0	1,600	2·1	812	1·3	201
22	5·1	5,050	3·8	2,500	3·0	1,600	2·1	812	1·3	181
23	5·2	5,350	3·9	2,630	2·9	1,510	2·1	812	1·4	265
24	5·0	4,760	4·1	2,910	2·8	1,420	2·1	812	1·6	416
25	5·1	5,050	4·2	3,060	2·8	1,420	2·0	730	1·7	483
26	5·2	5,350	4·2	3,060	2·8	1,420	2·0	730	1·7	483
27	4·9	4,490	4·1	2,910	2·9	1,510	2·0	730	1·7	483
28	4·8	4,240	4·3	3,220	2·8	1,420	2·0	730	1·7	483
29	4,7	4,000	4·2	3,060	2·8	1,420	2·0	730	1·8	571
30	4·2	3,060	4·5	3,580	2·8	1,420	1·9	650	.....	.....
31	4·0	2,770	4·2	3,060	.....	.....	1·9	650	.....	.....

KICKING HORSE RIVER NEAR FIELD.

Location.—In township 28, range 18, west 5th meridian, below the mouth of Yoho river, on the first traffic bridge, $3\frac{1}{4}$ miles east of Field.

Records Available.—June to November, 1912; June to December, 1913.

Winter Conditions.—Severe (−40° F.), with heavy snowfall. The river generally remains frozen from the end of November to April. Frazil ice is to be contended with.

Gauge.—A chain gauge is used and read three times a week by Mr. Wm. Oke, of Field, B.C.

Channel.—The channel is straight for 50 yards above and below the station, the water is very swift during freshet, the control fairly permanent.

Discharge Measurements.—Eight well distributed measurements in 1912, and eight in 1913 were made from traffic bridge above mentioned.

Accuracy.—The gauge readings are not frequent. The discharge measurements made in 1913 all agreed to within 2 per cent of the measurements made in 1912. The results at this station are within 10 per cent.

Kicking Horse River near Field, B.C., looking upstream from foot of Canyon.

Discharge Measurements of Kicking Horse River near Field, B.C., for 1912-1913.

Date.	Hydrographer.	Meter No.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1912.			Feet.	Sq.-ft.	Ft. per sec.	Feet.	Sec.-ft.
June 6	C. E. Richardson	1,048	58	120	2·46	4·4	295
June 25	do	1,048	145	403	8·88	7·0	3,596
June 26	do	1,048	145	488	9·65	7·6	4,710
June 29	do	1,048	145	325	8·05	6·4	2,620
July 2	do	1,048	145	272	7·14	6·0	1,940
Aug. 13	do	1,048	73	192	5·00	5·35	963
Oct. 2	do	1,048	53	102	2·10	3·70	214
Nov. 19	do	1,048	45	738	1·60	3·10	116
1913.							
May 22	do	1,048	60	126	2·40	4·15	300
July 3	do	1,048	73	220	5·82	5·70	1,280
July 28	do	1,048	88	300	7·40	6·30	2,220
July 30	do	1,048	75	206	5·90	5·55	1,200
July 31	do	1,048	89	281	7·70	6·20	2,190
Aug. 28	R. G. Swan	1,048	88	297	7·80	6·30	2,300
Sept. 12	do	1,048	61	155	3·20	4·80	496
Dec. 1	C. E. Webb	1,048	45	55·2	1·55	2·95	85·8

Monthly Discharge of Kicking Horse River at Field below Yoho River for 1913.

(Drainage area, 130 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
June	2,870	810	1,696	13,04	14·54	101,000
July	3,050	715	1,872	14·40	16·60	115,000
August	2,870	810	1,900	14·61	16·85	117,000
September	910	300	502	3·86	4·31	29,800
October	275	115	163	1·25	1·44	10,000
November	115	95	106	0·81	0·90	6,310
December	95	75	82	0·63	0·73	5·040

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Daily Gauge Heights and Discharges of Kicking Horse River near Field, below the Yoho, River for 1913.

Day.	June.	
	Gauge Height.	Discharge.
	Feet.	Sec.-ft.
1	5·7	1,410
2	5·8	1,550
3	5·9	1,710
4	5·9	1,710
5	5·8	1,550
6	5·7	1,410
7	5·9	1,710
8	6·1	2,030
9	6·3	2,350
10	6·6	2,870
11	6·5	2,680
12	6·4	2,500
13	6·3	2,350
14	6·0	1,870
15	5·7	1,410
16	5·4	1,020
17	5·2	810
18	5·5	1,140
19	5·9	1,710
20	6·2	2,190
21	6·0	1,870
22	5·9	1,710
23	5·7	1,410
24	5·7	1,410
25	5·7	1,410
26	5·6	1,270
27	5·5	1,140
28	5·7	1,410
29	5·8	1,550
30	5·9	1,710
31		

DAILY GAUGE HEIGHTS AND DISCHARGES of Kicking Horse River near Field below Yoho River for 1913—*Continued.*

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	6·2	2,190	6·3	2,350	5·3	910	4·2	275	3·2	115	3·0	95
2	6·0	1,870	6·3	2·350	5·2	810	4·1	255	3·2	115	3·0	95
3	5·7	1,410	6·4	2,500	5·2	810	4·0	235	3·2	115	3·0	95
4	5·7	1,410	6·6	2,870	5·2	810	3·9	215	3·2	115	3·0	95
5	5·6	1,270	6·5	2,680	5·3	910	3·8	200	3·2	115	3·0	95
6	5·8	1,550	6·4	2,500	5·3	910	3·7	185	3·2	115	3·0	95
7	6·4	2,500	6·3	2,350	5·3	910	3·7	185	3·2	115	3·0	95
8	6·3	2,350	6·2	2,190	5·1	715	3·7	185	3·2	115	3·0	95
9	6·1	2,030	6·1	2,030	5·0	630	3·6	170	3·2	115	2·9	85
10	6·1	2,030	6·1	2,030	4·9	560	3·6	170	3·2	115	2·9	85
11	6·0	1,870	6·2	2,190	4·9	560	3·6	170	3·2	115	2·9	85
12	5·7	1,410	6·4	2,500	4·8	500	3·5	160	3·2	115	2·9	85
13	5·5	1,140	6·3	2,350	4·7	450	3·5	160	3·2	115	2·9	85
14	5·3	910	6·0	1,870	4·6	400	3·5	160	3·1	105	2·8	75
15	5·1	715	5·7	1,410	4·6	400	3·4	145	3·1	105	2·8	75
16	5·1	715	5·5	1,140	4·6	400	3·4	145	3·1	105	2·8	75
17	5·1	715	5·4	1,020	4·5	360	3·4	145	3·1	105	2·8	75
18	5·5	1,140	5·4	1,020	4·5	360	3·4	145	3·1	105	2·8	75
19	5·8	1,550	5·3	910	4·4	330	3·4	145	3·1	105	2·8	75
20	6·1	2,030	5·2	810	4·4	330	3·4	145	3·1	105	2·8	75
21	6·4	2,500	5·3	910	4·3	300	3·4	145	3·0	95	2·8	75
22	6·4	2,500	5·5	1,140	4·3	300	3·4	145	3·0	95	2·8	75
23	6·4	2,500	6·0	1,870	4·3	300	3·4	145	3·0	95	2·8	75
24	6·6	2,870	6·2	2,190	4·3	300	3·4	145	3·0	95	2·8	75
25	6·7	3,050	6·2	2,190	4·3	300	3·3	130	3·0	95	2·8	75
26	6·6	2,870	6·2	2,190	4·3	300	3·3	130	3·0	95	2·8	75
27	6·4	2,500	6·1	2,030	4·3	300	3·3	130	3·0	95	2·8	75
28	6·3	2,350	6·0	1,870	4·3	300	3·3	130	3·0	95	2·8	75
29	6·0	1,870	6·0	1,870	4·3	300	3·3	130	3·0	95	2·8	75
30	6·1	2,030	6·1	2,030	4·3	300	3·2	115	3·0	95	2·8	75
31	6·2	2,190	5·8	1,550	.....	.....	3·2	115	.....	.....	2·8	75

KICKING HORSE RIVER NEAR NO. 2 TUNNEL

Location.—In township 28, range 18, west 5th meridian, above mouth of Yoho river, immediately above C.P.R. bridge over the Kicking Horse between No. 1 and No. 2 tunnels, 5 miles east of Field.

Records Available.—July to October, 1912; April to December, 1913.

Gauge.—An enamelled iron vertical staff gauge is used and read twice daily by C. E. Hamilton of Field, B.C.

Channel.—The channel is straight for 25 yards above and below the section. The control appears permanent.

Discharge Measurements.—Measurements are made by the "cable carrier system" described heretofore in this report. Six measurements were made in 1912, and six in 1913.

Accuracy.—Accurate gauge readings are obtained. The discharge measurements seem to vary somewhat with each other. The results are guaranteed to be within 15 per cent.

General.—The differences in discharge between the stations Kicking Horse near Field and Kicking Horse near No. 2 tunnel give the discharge of Yoho river.

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Discharge Measurements of Kicking Horse River near No. 2 Tunnel for 1912—1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet.	Sq ft.	Ft. per sec.	Feet.	Sec.-ft.
June 28	C. E. Richardson	1,048	42	110	4·01	5·00	470
July 2	"	1,048	40	885	3·58	4·20	299
Aug. 5	"	1,048	40	944	3·94	4·45	378
Aug. 13	"	1,048	39	810	3·33	3·85	270
Oct. 2	"	1,055	30	266	2·24	2·08	[1]59·5
Nov. 19	"	1,048	15	115	2·70	1·73	[1]30·8
1913.							
May 21	"	1,048	32	282	2·50	2·45	73·3
July 3	"	1,048	41	805	4·00	3·85	320
July 28	"	1,048	40·6	896	3·72	3·90	335
July 30	"	1,048	38·6	635	3·60	2·50	[2]230
Aug. 28	"	1,048	40·0	644	3·92	2·38	252
Dec. 1	C. E. Webb	1,048	14·0	108	2·40	0·90	253

Note.—[1]Different section.
[2]Gauge datum raised 1 foot.

Monthly Discharge of Kicking Horse River above mouth of Yoho River for 1913.

(Drainage area, 50 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April	52	25	34	0·68	0·76	2,020
May	396	17	94	1·88	2·17	5,780
June	770	222	438	8·76	9·77	26,000
July	491	187	341	6·82	7·86	21,000
August	517	204	291	5·82	6·71	17,900
September	351	96	166	3·32	3·70	9,880
October	96	42	60	1·20	1·38	3,690
November	42	25	32	0·64	0·71	1,900
*December	21	21	21	0·42	0·48	1,290

Note.—* Estimated — some gauge readings were affected by ice conditions.

Daily Gauge Heights and Discharges of Kicking Horse River above mouth of Yoho River for 1913.

Day.	April.		May.		June.	
	Gauge Height	Discharge.	Gauge Height	Discharge.	Gauge Height	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	1·8	17	4·6	491
2	.....	.....	1·8	17	4·7	517
3	.....	.....	1·8	17	4·6	491
4	.....	.....	1·8	17	4·6	491
5	.....	.....	1·8	17	4·6	491
6	.....	.....	1·8	17	4·2	396
7	.....	.....	1·8	17	4·2	396
8	.....	.....	1·8	17	4·6	491
9	.....	.....	1·8	17	5·2	667
10	.....	.....	1·8	17	5·4	734
11	.....	.....	1·9	25	5·5	770
12	.....	.....	2·0	33	5·1	634
13	.....	.....	2·1	42	5·0	603
14	1·9	25	2·1	42	4·8	445
15	1·9	25	2·1	42	4·2	396
16	1·9	25	2·1	42	3·8	305
17	1·9	25	2·1	42	3·6	262
18	2·0	33	2·1	42	3·4	222
19	2·1	42	2·2	52	3·8	305
20	2·2	52	2·3	62	4·8	445
21	2·2	52	2·5	84	4·6	491
22	2·2	52	2·6	96	4·1	373
23	2·1	42	2·7	110	4·0	351
24	2·0	33	2·9	140	4·0	351
25	2·0	33	3·0	115	4·0	351
26	2·0	33	3·2	187	4·1	373
27	2·0	33	3·3	204	3·9	328
28	1·9	25	3·5	242	3·8	305
29	1·9	25	4·0	351	3·9	328
30	1·9	25	4·1	373	4·0	351
31	.....	.....	4·2	396		

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DAILY GAUGE HEIGHTS AND DISCHARGES of Kicking Horse River above mouth of Yoho River for 1913.—*Continued.*

Day.	July.		August.		September.		October		November.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	4·3	419	3·6	262	3·5	242	2·5	84	2·1	42
2	4·5	466	3·8	305	3·0	155	2·6	96	2·0	33
3	4·0	351	4·0	351	2·9	140	2·6	96	2·0	33
4	3·8	305	4·0	351	3·5	242	2·5	84	2·0	33
5	3·7	283	4·0	351	4·0	351	2·5	84	2·0	33
6	3·6	262	4·0	351	3·5	242	2·5	84	2·0	33
7	4·5	466	4·1	375	3·4	222	2·4	73	2·0	33
8	4·2	396	4·3	419	3·3	201	2·4	73	2·0	33
9	4·0	351	4·0	351	3·5	242	2·3	62	2·0	33
10	4·3	419	3·9	326	3·5	242	2·3	62	2·0	33
11	4·2	396	3·8	305	3·1	170	2·3	62	2·0	33
12	3·8	305	4·0	351	3·1	170	2·3	62	2·0	33
13	3·6	262	4·7	517	3·1	170	2·3	62	2·0	33
14	3·4	222	4·2	396	3·2	187	2·3	62	2·0	33
15	3·4	222	3·9	328	3·0	155	2·3	62	2·0	33
16	3·3	204	3·7	283	3·0	155	2·2	52	2·0	33
17	3·2	187	3·5	242	2·9	140	2·2	52	2·0	33
18	3·4	222	3·5	242	3·0	155	2·2	52	2·0	33
19	3·6	262	3·4	222	3·0	155	2·2	52	2·0	33
20	4·0	351	3·3	204	3·0	155	2·2	52	2·0	33
21	4·1	442	3·3	204	2·9	140	2·2	52	2·0	33
22	4·6	491	3·3	204	2·9	140	2·2	52	2·0	33
23	4·5	466	3·3	204	2·8	185	2·1	42	2·0	33
24	4·4	442	3·4	222	2·7	119	2·1	42	2·0	33
25	4·5	466	3·5	242	2·7	110	2·1	42	2·0	33
26	4·3	419	3·5	242	2·6	96	2·1	42	2·0	33
27	4·1	373	3·6	262	2·6	96	2·1	42	1·9	25
28	3·9	328	3·4	222	2·6	96	2·1	42	1·9	25
29	3·8	305	3·4	222	2·6	96	2·1	42	1·9	25
30	3·6	262	3·5	242	2·6	96	2·1	42	1·9	25
31	3·4	222	3·4	222			2·1	42		

KOOTENAY RIVER AT GLADE.

Location.—Ten miles from the mouth, below the mouth of Slocan river, 16 miles from Nelson, at the ferry cable near Glade, B.C.

Records Available.—May to December, 1913.

Winter Conditions.—The thermometer seldom goes below zero; the snowfall is fairly heavy; the river never freezes over.

Gauge.—Four 5 foot gauges, reading from 0 to 5 feet, 5 to 10 feet, 10 to 15 feet, and from 15 to 20 feet are used, and read twice daily by F. Striloiff of Glade, B.C.

Channel.—The channel is straight for quarter of a mile above and below section and very uniform. There are riffles 1,000 yards above and below the section which is ideal for metering purposes.

Discharge Measurements.—Seven well-distributed measurements were made during 1913 from a cable car used on a ferry cable.

Accuracy.—Accurate gauge readings are obtained, accurate measurements were taken, and the gauge-height-discharge curve is very satisfactory. The results at this station are guaranteed to be within 5 per cent.

General.—The Kootenay river is one of the largest and most important rivers in British Columbia. It rises in the Beaverfoot range of the Rocky

mountains, in township 24, range 17, west 5th meridian. It flows in practically a southerly direction for 175 miles, where it crosses the border into the state of Montana. It re-enters Canada from Idaho at a point about 60 miles west from where it entered Montana. The river is now flowing almost due north through an extensive area of bottom land which is submerged in high water. About 15 miles from the border the river loses itself in beautiful Kootenay lake, famous to all travellers along the Crowsnest route of the C.P.R. Kootenay lake is 75 miles long—north and south—and from 2 to 6 miles wide. About 30 miles from the southern end of the lake is what is called the west Arm of Kootenay lake. This arm gradually narrows down till about 3 miles west of Nelson, a pronounced riffle shows us that we are once more following a river. From this point to the mouth is a distance of about 25 miles, in which the river falls about 350 feet, affording various power sites including Upper Bonnington and Bonnington falls. The Kootenay discharges into Columbia river shortly below Arrow lakes, and about 25 miles above the international boundary line.

From a hydrographic point there are three outstanding features on the Kootenay.

(1) Power developments and possibilities between Kootenay lake and the mouth of the river.

(2) The possibilities of a reclamation scheme to reclaim thousands of acres of land in Idaho and British Columbia between Kootenay lake and the international boundary line.

(3) Kootenay is an international stream—flowing into Montana from British Columbia, through Idaho back into British Columbia.

1. *Power.*—At the present time there are three power developments on Kootenay river between Kootenay lake and the mouth of the river.

(a) At Upper Bonnington falls the West Kootenay Light and Power Company have a plant which develops 16,000 horse-power, and two extra units are now being added which will increase the capacity to 36,000 horse power. From this plant power is supplied to light Trail, Rossland, Grand Forks, Phœnix, Greenwood, and Eholt; power is supplied to mines at Nelson, Rossland, Greenwood and Phœnix, to the smelters at Trail and Grand Forks, and for irrigation purposes in Grand Forks district. The proposed electrification of the C.P.R. between Rossland and Castlegar will be most probably supplied with power by the same company.

(b) The power-house of the City of Nelson Power and Light Company is located at Upper Bonnington falls also. This development is 1,250 k.w., and supplies power to the city of Nelson for light, for the street railway and for manufacturing purposes, and to a few mines in the vicinity of Nelson.

(c) The West Kootenay Light and Power Company have a development of 4,000 horse-power at Lower Bonnington falls, which is at present used only as an auxiliary plant.

There are various undeveloped sites in this section of the river and it has been estimated that 1,000,000 horse-power (24-hours) may at any time be developed at a low cost per horse-power.

2. *Reclamation.*—Through part of Idaho and that part of British Columbia between the boundary and Kootenay lake, Kootenay river winds its way through a valley from 1 to 3 miles wide. At low and medium stages the river is fairly well confined to a main channel and two or three side channels, but in high water the vast area of bottom land becomes a lake. This bottom land, if reclaimed, is very valuable, and several investigations have already been made, and it is anticipated that more thorough studies will be made in the near future. It is an international proposition.

3. Complications may set in at any time on the international streams and for that reason it is essential to know the amount of water flowing from one country into another where it is at all possible.

Discharge Measurements of Kootenay River near Glade, B.C., 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
June 13	C. E. R. & H. G. L.	1,048	720	16,000	9·63	24·5	154,000
July 3	H. G. L. & A. J. V.	1,527	706	12,400	8·38	19·8	104,000
" 31	H. G. L. & A. J. V.	1,527	655	8,930	6·21	14·6	55,500
Aug. 6	C. E. R. & J. A. E.	1,672	660	8,450	6·08	13·85	51,400
Sept. 6	H. G. L. & A. J. V.	1,527	600	6,980	4·81	11·50	33,600
Nov. 27	C. E. R. & A. J. V.	1,527	550	4,940	3·05	7·82	15,100
1914.							
Jan. 31	A. J. V. & C. E. W.	1,048	549	4,620	2·82	7·40	13,000

Note.—This station was established by C. E. Richardson and maintained during 1913 conjointly by W. J. E. Biker, Provincial Water Rights Engineer, Nelson, and the Dominion Hydrographic Survey.

Monthly Discharge of Kootenay River near Glade, B.C., for 1913.

(Drainage area, 19,000 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	[1]77,200	32,300	45,400	2·39	2·76	2,790,000
June	[1]154,000	93,000	126,000	6·63	7·40	7,500,000
July	108,000	56,300	78,900	4·15	4·78	4,850,000
August	54,700	32,100	42,900	2·26	2·61	2,640,000
September	33,600	23,100	28,600	1·50	1·67	1,700,000
October	22,100	18,000	19,400	1·02	1·18	1,190,000
November	17,000	15,000	15,900	0·84	0·94	946,000
December	15,000	9,900	12,400	0·65	0·75	762,000

Note.—Kootenay river near Glade, B.C., is 12 miles from mouth.
[1]Deduced by subtracting the discharges of Columbia at Castlegar from that at Trail.

Daily Gauge Heights and Discharges of Kootenay River near Glade, B.C., for 1913.

Day.	June.	
	Gauge Height.	Discharge.
	Feet.	Sec.-ft.
1	.....	.....
2	.....	.....
3	.....	.....
4	.....	.....
5	.....	.....
6	.....	.....
7	.....	.....
8	.....	.....
9	.....	.....
10	.....	.....
11	.....	.....
12	.....	.....
13	.....	.....
14	24·5	154,000
15	22·3	153,000
16	24·0	148,000
17	23·8	146,000
18	23·2	139,000
19	23·0	137,000
20	22·7	134,000
21	22·6	133,000
22	22·2	129,000
23	22·0	127,000
24	21·7	124,000
25	21·5	122,000
26	21·4	120,000
27	21·1	117,000
28	20·9	115,000
29	20·3	109,000
30	20·3	109,000
31	.....	.....

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DAILY GAUGE HEIGHTS AND DISCHARGES of Kootenay River near Glade, B.C., for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	20·2	108,000	14·4	54,700	11·3	32,100	9·5	22,100	8·5	17,000	7·8	15,000
2	20·1	107,000	14·3	53,900	11·2	31,500	9·4	21,600	8·2	16,600	7·8	15,000
3	19·8	104,000	14·2	53,100	11·1	30,900	9·4	21,600	8·2	16,600	7·8	15,000
4	19·65	102,000	14·1	52,300	11·3	32,100	9·3	21,200	8·2	16,600	7·7	14,600
5	19·45	100,000	13·9	50,800	11·55	33,600	9·1	20,100	8·1	16,200	7·7	14,600
6	19·1	97,000	13·8	50,000	11·5	33,300	9·1	20,400	8·1	16,200	7·6	14,200
7	18·85	94,600	13·65	48,900	11·4	32,700	9·0	20,000	8·1	16,200	7·6	14,200
8	18·7	93,200	13·5	47,800	11·4	32,700	9·0	20,000	8·1	16,200	7·5	13,900
9	18·5	91,300	13·5	47,800	11·4	32,700	9·0	20,000	8·1	16,200	7·5	13,900
10	18·25	88,900	13·4	47,000	11·4	32,700	9·0	20,000	8·0	15,800	7·4	13,500
11	18·05	87,000	13·3	46,300	11·4	32,700	8·9	19,600	8·0	15,800	7·4	13,500
12	17·85	85,000	13·25	45,900	11·2	31,500	8·9	19,600	8·0	15,800	7·3	13,100
13	17·65	83,000	13·2	45,500	11·1	30,900	8·8	19,200	8·0	15,800	7·3	13,100
14	17·45	81,000	13·1	44,800	11·0	30,300	8·8	19,200	8·0	15,800	7·2	12,800
15	17·25	79,200	13·0	44,000	10·8	29,100	8·9	19,600	8·0	15,800	7·1	12,400
16	16·95	76,600	12·9	43,200	10·5	27,300	8·8	19,200	8·0	15,800	7·1	12,400
17	16·65	74,000	12·8	42,400	10·5	27,300	8·8	19,200	8·0	15,800	7·0	12,000
18	16·35	71,400	12·7	41,600	10·5	27,300	8·8	19,200	8·0	15,800	7·0	12,000
19	16·15	69,800	12·6	40,800	10·4	26,700	8·8	19,200	8·0	15,800	6·9	11,600
20	15·9	67,600	12·5	40,100	10·3	26,100	8·7	18,800	8·0	15,800	6·9	11,600
21	15·7	65,800	12·4	39,400	10·2	25,600	8·7	18,800	8·0	15,800	6·8	11,300
22	15·7	65,800	12·25	38,400	10·2	25,600	8·7	18,800	8·0	15,800	6·8	11,300
23	15·6	46,900	12·1	37,300	10·1	25,100	8·6	18,100	8·0	15,800	6·7	11,000
24	15·6	64,900	11·9	35,900	10·0	24,600	8·6	18,100	8·0	15,800	6·7	11,000
25	15·5	64,000	11·8	35,200	10·0	24,600	8·6	18,400	8·0	15,800	6·6	10,600
26	15·1	63,100	11·8	35,200	9·9	24,100	8·6	18,400	8·0	15,800	6·6	10,600
27	15·3	62,200	11·7	34,500	9·9	24,100	8·5	18,000	7·9	15,400	6·5	10,200
28	15·1	60,400	11·6	33,900	9·8	23,600	8·5	18,000	7·9	15,400	6·5	10,200
29	15·0	59,500	11·5	33,300	9·8	23,600	8·5	18,000	7·8	15,400	6·5	10,200
30	14·8	57,900	11·4	32,700	9·7	23,100	8·5	18,000	7·8	15,000	6·4	9,900
31	11·6	56,000	11·3	32,100			8·5	18,000			6·4	9,900

NO. 2 CREEK.

Location.—No. 2 creek flows easterly into Columbia river from the Selkirk range, about 6 miles from Wilmer. The gauging station is located about 1 mile from the mouth of the highway bridge on road from Wilmer to Forster's Landing.

Records Available.—June to October, 1912; May to December, 1913.

Winter Conditions.—Severe (−40° F.), with light snowfall, as may be found in semi-arid districts in British Columbia. The river is generally frozen from November to April.

Gauge.—A staff gauge is used and read by Mrs. Colin MacKay of Mormish ranch, Wilmer.

Channel.—The channel winds immediately above the section and the water is always very fast; the station is not suitable for metering, but is the most desirable one to be obtained except by erecting a cable station.

Discharge Measurements.—Five measurements in 1912, and eight in 1913 were taken from the highway bridge.

Accuracy.—Accurate gauge heights are obtained, but the measuring section is very poor. These results guaranteed only to be within 15 and 20 per cent.

Discharge Measurements of No. 2 Creek near Forster's Landing for 1912-13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 29.....	H. C. Hughes.....	1,055	32	64	4·9	0·84	314
June 13.....	do	1,055	53	114	6·6	1·70	741
July 3.....	do	1,055	54	114	6·04	1·68	689
" 24.....	do	1,055	57	116	6·4	1·70	745
Sept. 28.....	C. E. Richardson.....	1,055	32	43	4·74	0·40	203
1913.							
May 16.....	C. E. R. & J. A. E...	1,672	35	402	4·58	0·54	[1]184
June 19.....	J. A. Elliott.....	1,672	90	161	5·78	1·55	[2]933
July 11.....	C. E. Richardson.....	1,048	88	155	7·00	1·70	[3]1,090
" 15.....	J. A. Elliott.....	1,672	90	209	6·62	2·00	[3]1,380
" 30.....	do	1,672	90	130	5·81	1·00	756
Sept. 3.....	C. E. R. & R. G. S.....	1,048	70	73	5·50	0·50	404
" 13.....	J. A. Elliott.....	1,672	70	71	6·30	0·42	[3]437
Nov. 27.....	C. E. Webb.....	1,048	34·5	36·2	3·32	−0·22	120

Note.—[1]Gauge shifted 0′-1″.
[2]New Gauge.
[3]Different section.

Monthly Discharge of No. 2 Creek near Forster's Landing for 1913.

(Drainage area, 200 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May.....	805	190	306	1·53	1·76	18,800
June.....	1,930	908	1,223	6·11	6·82	72,600
July.....	1,320	584	986	4·93	5·68	60,600
August.....	1,545	486	869	4·35	5·02	53,400
September.....	1,170	344	501	2·50	2·79	29,800
October.....	344	216	282	1·41	1·63	17,300
November.....	257	60	129	0·65	0·73	7,680
December[1].....	170	60	106	0·53	0·61	6,520

Note.—[1]Last 10 days in December estimated.

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Daily Gauge Heights and Discharges of No. 2 Creek near Forster's Landing for 1913.

Day	May.		June.	
	Gauge Height	Discharge	Gauge Height.	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	0·4	205	1·9	875
2	0·3	190	2·2	1 110
3	0·3	190	2·1	1,030
4	0·3	190	2·2	1,110
5	0·3	190	2·0	950
6	0·3	190	2·1	1,030
7	0·4	205	1·9	875
8	0·4	205	2·1	1,030
9	0·5	220	2·8	1,930
10	0·5	220	2·8	1,930
11	0·5	220	2·8	1,930
12	0·6	240	2·6	1,770
13	0·5	220	2·5	1,695
14	0·3	190	2·4	1,620
15	0·3	190	1·9	1,245
16	0·3	190	1·6	1,030
17	0·4	205	1·4	908
18	0·4	205	1·4	908
19	0·4	205	1·6	1,030
20	0·4	205	2·2	1,470
21	0·5	220	1·9	1,245
22	0·7	270	1·6	1,030
23	0·9	335	1·6	1,030
24	0·8	300	1·7	1,100
25	1·1	410	1·6	1,030
26	1·2	455	2·0	1,320
27	1·4	555	1·7	1,100
28	1·6	670	1·7	1,100
29	1·7	735	1·8	1,170
30	1·6	670	1·7	1,100
31	1·8	805	.....	...

DAILY GAUGE HEIGHTS AND DISCHARGES of No. 2 Creek near Forster's Landing for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·8	1,170	1·4	908	0·9	634	0·3	344	0·1	257	−0·3	90
2	1·9	1,245	1·7	1,100	0·7	335	0·3	344	0·0	216	−0·3	90
3	1·4	908	2·1	1,395	0·8	584	0·3	344	−0·2	132	−0·4	60
4	1·3	849	2·0	1,320	1·3	849	0·3	344	−0·2	132	−0·2	132
5	1·3	849	1·8	1,170	1·8	1,170	0·2	300	−0·1	257	−0·2	132
6	1·4	908	1·7	1,100	1·0	686	0·1	257	−0·2	132	−0·2	132
7	1·9	1,245	1·8	1,170	0·8	584	0·1	257	−0·1	170	−0·3	90
8	1·7	1,100	2·3	1,545	0·8	584	0·2	300	−0·2	132	−0·3	90
9	1·7	1,100	1·6	1,030	0·7	535	0·3	344	−0·2	132	−0·2	132
10	1·9	1,245	1·5	968	0·6	486	0·3	344	−0·2	132	−0·3	90
11	1·7	1,100	1·5	968	0·5	437	0·2	300	−0·2	132	−0·2	132
12	1·5	968	1·5	968	0·5	437	0·2	300	−0·2	132	−0·2	132
13	1·4	908	1·6	1,030	0·4	390	0·2	300	−0·4	60	−0·2	132
14	1·0	686	1·1	738	0·4	390	0·1	257	−0·4	60	−0·1	170
15	0·9	634	1·0	686	0·3	544	0·1	257	−0·2	132	−0·2	132
16	0·8	584	0·8	584	0·4	390	0·2	300	−0·2	132	−0·3	90
17	0·9	634	0·7	535	0·4	390	0·1	257	−0·2	132	−0·4	60
18	0·9	634	0·7	535	1·0	686	0·1	257	−0·2	132	−0·2	132
19	1·3	849	0·6	486	0·6	486	0·2	300	−0·8	132	−0·2	132
20	1·4	908	0·6	486	0·5	437	0·1	257	−0·2	132	−0·2	132
21	1·8	1,170	0·6	486	0·6	486	0·1	257	−0·4	60	−0·25	111
22	1·9	1,245	0·7	535	0·4	390	0·1	257	−0·4	60	.....	.....
23	2·0	1,320	1·1	738	0·4	390	0·1	257	.....	.....	.....	.....
24	1·9	1,245	1·3	849	0·4	390	0·1	257	.....	.....	.....	.....
25	2·0	1,320	1·2	792	0·4	390	0·1	257	.....	.....	.....	.....
26	1·8	1,170	1·2	792	0·4	390	0·2	300	.....	.....	.....	.....
27	1·6	1,030	1·3	849	0·4	390	0·1	257	−0·2	.....	.....	.....
28	1·6	1,030	1·0	686	0·3	344	0·0	216	.....	.....	.....	.....
29	1·5	968	1·3	849	0·5	437	0·0	216	.....	.....	.....	.....
30	1·1	738	1·2	790	0·4	390	0·1	257	.....	.....	.....	.....
31	1·2	792	1·3	849	.....	.....	0·1	257	.....	.....	.....	.....

OTTERTAIL RIVER

Location.—The gauging section is located in township 27, range 19, west 5th meridian 5½ miles west of Field, just above the highway bridge on road Field to Ottertail. (Old C.P.R. grade.)

Records Available.—June to October, 1912; May to October, 1913.

Winter Conditions.—Winters in this district are very severe, the thermometer going as low as −40° F. The snowfall is heavy, and even in the valleys snow is on the ground for from four to six months in the year. The river is generally frozen from November to April.

Gauge.—The gauge is a vertical staff gauge and is read by Mr. Wm. Haygarth two or three times a week.

Channel.—The channel is straight for 50 yards above and below the section. The water is swift and there are riffles immediately above and below.

Discharge Measurements.—In 1912, four measurements were made from temporary foot-bridge. In 1913, six measurements were made by means of "cable carrier system."

Accuracy.—Gauge readers are infrequent; the measuring section is not very good; these results are guaranteed to be within 15 per cent.

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Discharge Measurements of Ottertail River near Field for 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1913							
May 22	C. E. Richardson	1,048	28	69·6	2·00	2·80	138
July 3	do	1,048	44	119·5	5·11	3·60	598
July 28	do	1,048	44	104·5	4·70	3·50	491
July 31	do	1,048	44	93·5	3·60	3·30	337
Aug. 29	R. G. S. & C. E. R.	1,048	30	91·0	3·70	3·25	337
Dec. 1	C. E. Webb	1,048	34	56·2	1·27	2·10	71

Monthly Discharge of Ottertail River near Field for 1913.

Drainage area, 90 square miles.

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	930	40	178	1·98	2·28	10,900
June	1,350	490	829	9·21	10·3	49,300
July	740	290	523	5·81	6·75	32,200
August	740	200	435	4·83	5·57	26,700
September	570	145	269	2·99	3·34	16,000
October	145	85	115	1·28	1·48	7,070

Daily Gauge Heights and Discharges of Ottertail River near Field for 1913.

Day.	May.		June.	
	Gauge Height.	Discharge	Gauge Height.	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·2	50	4·1	1,030
2	2·2	50	4·2	1,130
3	2·2	50	4·3	1,240
4	2·2	50	4·2	1,130
5	2·1	40	4·1	1,030
6	2·1	40	3·9	830
7	2·2	50	4·0	930
8	2·3	60	4·2	1,130
9	2·4	70	4·4	1,350
10	2·3	60	4·3	1,240
11	2·2	50	4·2	1,130
12	2·3	60	4·1	1,030
13	2·4	70	4·0	930
14	2·4	70	3·8	740
15	2·4	70	3·7	650
16	2·4	70	3·6	570
17	2·3	60	3·5	490
18	2·2	50	3·7	650
19	2·5	85	3·8	740
20	2·6	103	4·0	930
21	2·7	125	3·9	830
22	2·7	125	3·8	740
23	2·8	145	3·7	650
24	2·9	170	3·6	570
25	3·0	200	3·6	570
26	3·2	290	3·5	490
27	3·3	350	3·5	490
28	3·5	490	3·5	490
29	3·7	650	3·6	570
30	3·9	830	3·6	570
31	4·0	930	.....	.....

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DAILY GAUGE HEIGHTS AND DISCHARGES of Ottertail River near Field for 1913.—*Continued.*

Day.	July.		August.		September.		October.		December.	
	Gauge Height.	Discharge.	Gauge Height	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height	Discharge
	Feet.	Sec. ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec. ft.
1	3·8	740	3·5	490	3·2	290	2·7	125	2·4	70
2	3·7	630	3·5	490	3·2	290	2·6	105	.....	.....
3	3·6	570	3·6	570	3·0	350	2·5	85	.....	.....
4	3·5	490	3·6	570	3·4	420	2·6	105	.....	.....
5	3·5	490	3·7	650	3·6	570	2·7	125	.....	.....
6	3·6	570	3·7	650	3·5	490	2·7	125	.....	.....
7	3·6	570	3·6	570	3·4	420	2·8	145	.....	.....
8	3·7	650	3·5	490	3·3	350	2·8	145	.....	.....
9	3·7	650	3·5	490	3·3	350	2·8	145	.....	.....
10	3·6	570	3·6	570	3·2	290	2·8	145	.....	.....
11	3·5	490	3·7	650	3·2	290	2·8	145	.....	.....
12	3·4	420	3·8	740	3·2	290	2·7	125	.....	.....
13	3·4	420	3·7	650	3·2	290	2·7	125	.....	.....
14	3·3	350	3·5	490	3·2	290	2·7	125	.....	.....
15	3·2	290	3·4	420	3·1	240	2·7	125	.....	.....
16	3·3	350	3·4	420	3·1	240	2·7	125	.....	.....
17	3·4	420	3·4	420	3·1	240	2·7	125	.....	.....
18	3·4	420	3·3	350	3·0	200	2·7	125	.....	.....
19	3·5	490	3·3	350	3·0	200	2·7	125	.....	.....
20	3·6	570	3·2	290	3·0	200	2·6	105	.....	.....
21	3·7	650	3·1	240	3·0	200	2·6	105	.....	.....
22	3·8	740	3·0	200	3·0	200	2·6	105	.....	.....
23	3·7	650	3·0	200	3·0	200	2·6	105	.....	.....
24	3·6	570	3·0	200	3·0	200	2·6	105	.....	.....
25	3·5	490	3·1	240	2·9	170	2·6	105	.....	.....
26	3·5	490	3·3	350	2·9	170	2·6	105	.....	.....
27	3·5	490	3·3	350	2·9	170	2·5	85	.....	.....
28	3·5	490	3·3	350	2·9	170	2·5	85	.....	.....
29	3·5	490	3·3	350	2·8	145	2·5	85	.....	.....
30	3·5	490	3·3	350	2·8	145	2·5	85	.....	.....
31	3·5	490	3·3	350	.....	.....	2·5	85	.....	.....

PEND D'OREILLE RIVER.

(Also commonly called Clark's Fork of Columbia River.)

Location.—The gauging station is located 9 miles above the mouth at Waneta, near Mr. A. G. Lang's ranch.

Records Available.—May to December, 1913.

Winter Conditions.—The winter conditions are not severe in this district, the temperature is seldom below 0° F.; the snowfall is fairly heavy. The river seldom freezes, and never for more than a day or so at a time. It is claimed that the waters of the Pend d'Oreille are warmer than the waters of other streams of British Columbia.

Gauge.—Staff gauges are used and read two or three times a week, except during high water, when they are read daily by Mr. A. G. Lang.

Channel. — The Pend d'Oreille during its course through Canada is very torrential, and there is no favourable metering section. The section chosen is very fast in high water, satisfactory at low water stages, and it appears to have a permanent control.

Discharge Measurements.—Measurements are made from a cable car. To date, twelve well distributed measurements have been made.

Accuracy.—Accurate, though somewhat infrequent gauge readings have been made. Conditions for low-water measurements are favourable, and except

during high water the results are guaranteed to be within 5 per cent; during June and July accuracy is guaranteed to be within 10 per cent.

General. — Pend d'Oreille river has its source in (*a*) British Columbia, on the western slope of the Rocky mountains, where it is known as Flathead river; (*b*) near Helena, Montana, where it is known as Clark's Fork of the Columbia, Missoula river, and several other local names. It drains about 25,500 square miles in Montana, Idaho, and Washington before entering British Columbia, from whence it flows 16 miles in a westerly direction, discharging into the Columbia river at Waneta, B.C., 200 yards from the international boundary, The total drainage area of Pend d'Oreille river is about 26,600 square miles. Salmon river drains 480 square miles, being the only important tributary in Canada.

During its course in British Columbia, the Pend d'Oreille has a fall of 423 feet, and four or five sites for large power developments are available. There are not any distinctive falls greater than 10 feet in height. The rise and fall of the river is about 20 feet, and at high water due to narrow and uneven banks and bed the river is very wild.

The gauging and metering section was established in 1912 under the direction of Mr. G. Gray Donald. The cable is $1\frac{1}{4}$ inches in diameter and has a clear span of 610 feet. Measurements are made from a cable car. During 1913, the provincial district engineer, Water Rights Branch, Nelson, and the British Columbia Hydrographic Surveys co-operated on this station until October, when the British Columbia Hydrographic Surveys took complete charge.

Discharge Measurements of Pend d'Oreille River near Waneta, B. C. 1912–13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Oct. 11	Wilson			2,900	3·52	3·89	10,200
Nov. 15	do			3,250	4·02	5·14	13,100
1913							
Jan. 25	do			2,550	3·16	2·84	8,070
Feb. 9	do			2,380	2·94	2·24	7,000[1]
Mar. 3	do			2,600	2·92	3·04	7,620
Mar. 24	do			2,710	3·20	3·54	8,660
June 11	W. E. B. & C. E. R.			10,400	11·40	25·25	119,000
June 25	H. G. L.			9,940	10·69	24·20	106,000
July 15	do			7,090	8·40	17·10	59,600
Aug. 4	do			4,780	6·03	10·24	28,800
Sept. 2	do			3,380	4·19	5·41	14,170
Nov. 6	C. E. R. & C. E. W.			2,570	3·16	3·00	8,300

Note.—[1]Ice conditions.

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Monthly Discharge of Pend d'Oreille River near Waneta, B. C. for 1913.

(Drainage area, 26,600 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
June	116,000	88,000	106,000	3·98	4·44	6,310,000
July	92,900	32,400	59,600	2·24	2·59	3,666,000
August	31,200	14,800	21,500	0·81	0·93	1,320,000
September	14,600	8,580	11,100	0·42	0·47	661,000
October	8,340	7,660	7,920	0·30	0·35	487,000
November	9,780	8,100	8,840	0·33	0·37	526,000
December	9,780	6,200	7,890	0·29	0·33	481,000

Note.—Pend d'Oreille plus Columbia near Trail gives the discharge of the Columbia flowing into the United States.

Daily Gauge Heights and Discharges of Pend d'Oreille River near Waneta, for 1913.

Day	June.	
	Gauge Height.	Discharge.
	Feet.	Sec.-ft.
1	21·5	88,000
2	22·0	91,500
3	22·3	93,600
4	22·8	97,200
5	23·0	98,600
6	23·5	102,000
7	24·0	106,000
8	24·6	111,100
9	24·8	112,000
10	25·0	114,000
11	25·1	114,000
12	25·2	115,000
13	25·3	116,000
14	25,3	116,000
15	25·2	115,000
16	25·1	114,000
17	24·9	113,000
18	24·8	112,000
19	24·7	111,000
20	24·6	111,000
21	24·5	110,000
22	24·4	109,000
23	24·3	108,000
24	24·2	108,000
25	24·1	107,000
26	23·6	103,000
27	23·4	102,000
28	23·0	90,600
29	22·7	96,500
30	22·4	94,300

DAILY GAUGE HEIGHTS AND DISCHARGES of Pend d'Oreille River near Waneta, for 1913—*Continued.*

DAY.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	22·2	92,900	10·9	31,200	5·6	14,600	3·1	8,340	3·0	8,100	3·7	9,780
2	21·8	90,100	10·7	30,500	5·4	14,000	3·1	8,340	3·0	8,100	3·7	9,780
3	21·5	88,000	10·4	29,400	5·4	14,000	3·0	8,100	3·0	8,100	3·7	9,780
4	21·3	86,600	10·2	28,700	5·4	14,000	2·9	7,880	3·0	8·100	3·6	9,540
5	20·8	83,200	10·0	28,000	5·3	13,800	2·9	7,880	3·0	8,100	3·6	9,540
6	20·4	80,600	9·8	27,300	5·2	13,500	2·9	7,880	3·0	8,100	3·5	9,300
7	20·1	78,700	9·6	26,600	5·0	13,000	2·9	7,880	3·1	8,340	3·4	9,060
8	19·8	76,700	9·4	26,000	4·8	12,500	2·9	7.880	3·1	8,340	3·3	8,820
9	19·5	74,800	9·1	24,900	4·6	12,000	2·9	7,880	3·1	8,340	3·2	8,580
10	19·1	72,200	8·9	24,300	4·5	11,800	2·8	7,660	3·1	8,340	3·2	8,580
11	18·7	69,800	8·7	23,600	4·4	11,500	2·9	7,880	3·2	8,580	3·1	8,340
12	18·3	67,300	9·5	23,000	4·4	11,500	3·0	8,100	3·2	8,580	3·1	8,340
13	18·0	63,500	8·2	22,000	4·3	11,300	2·9	7,880	3·2	8,580	3·0	8,100
14	17·5	62,600	8·0	21,300	4·1	10,800	2·9	7,880	3·2	8,580	2·9	7,880
15	17·1	60,200	7·9	21,000	4·0	10,500	2·9	7,880	3·2	8,580	2·9	7,880
16	16·6	57,400	7·8	20,700	4·0	10,500	3·0	8,100	3·3	8,820	2·8	7,660
17	16·3	55,700	7·6	20,100	3·9	10,300	3·0	8,100	3·3	8,820	2·8	7,660
18	51·0	34,000	7·5	14,800	3·9	10,300	3·0	8,100	3·4	9,060	2·7	7,440
19	15·6	51,900	7·3	19,200	3·8	10,000	3·0	8,100	3·4	9,060	2·7	7,440
20	15·0	48,700	7·2	18,900	3·7	9,780	3·0	8,100	3·4	9,060	2·6	7,220
21	14·7	47,200	7·0	18,300	3·7	9,780	3·0	8,100	3·5	9,300	2·5	7,000
22	14·3	45,300	6·8	17,800	3·7	9,780	2·9	7,880	3·5	9,300	2·4	6,800
23	13·9	43,400	6·7	17,500	3·6	9,540	2·9	7,880	3·5	9,300	2·3	6,600
24	13·5	41,600	6·5	17,000	3·6	9,540	2·9	7,880	3·6	9,540	2·3	6,600
25	13·1	39,800	6·4	16,700	3·5	9,300	2·8	7,660	3·6	9,540	2·3	6,600
26	12·8	38,600	6·3	16,400	3·5	9,300	2·8	7,660	3·6	9,540	2·3	6,600
27	12·5	37,400	6·2	16,100	3·4	9,060	2·8	7,660	3·6	9,540	2·3	6,600
28	12·1	35,800	6·0	15,600	3·3	8,820	2·8	7,660	3·7	9,780	2·2	6,400
29	11·8	34,600	5·9	15,300	3·2	8,580	2·8	7,660	3·7	9,780	2·2	6,400
30	11·4	33,100	5·8	15,100	3·2	8,580	2·8	7,660	3·7	9,780	2·1	6,200
31	11·2	32,400	5·7	14,800	.....	.....	2·9	7,880	.....	.....	2·1	6,200

SLOCAN RIVER.

Location.— In Slocan Junction precinct, Nelson water district, about one mile from the mouth on the highway bridge near Crescent Valley.

Winter Conditions.—The snowfall is fairly heavy, but the thermometer rarely falls below zero, and the river seldom freezes.

Gauge.—Vertical staff gauge, fastened to bridge cribbing.

Channel.—Straight above and below the section for 100 yards and inclined to shift.

Discharge Measurements.—Seven well distributed measurements were made in 1913 from the traffic bridge near Crescent valley.

Accuracy.—The meterings are reliable, and the gauge readings are frequent. The channel is shifting, and the control does not appear to be permanent. It is claimed that during high water the Kootenay river causes a backwater effect on the gauge. Accuracy, January to May, 15 per cent; June to August, 20 per cent; September to December, 10 per cent.

General.—The results herewith are obtained through the courtesy of W. J. E. Biker, Provincial Water Rights Engineer, Nelson District, who maintained the station during 1913. These results are published to show the discharge of Kootenay river at Bonnington falls. The British Columbia Hydrographic Survey gauging station on Kootenay river is below the mouth of Slocan river.

Monthly Discharge of Slocan River near Crescent Valley for 1913.

(Drainage area, 2,100 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.		Accuracy
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in Acre-feet.	
January	780	530	655	0·58	0·67	40,300	C
February	850	430	640	0·57	0·59	35,500	C
March	630	280	455	0·38	0·44	28,000	C
April	4,230	350	2,290	2·04	2·28	136,000	C
May	16,160	3,360	9,760	8·71	10·04	600,000	C
June	22,000	10,000	16,000	14·28	15·93	952,000	D
July	10,500	4,230	7,370	6·58	7·59	453,000	D
August	4,140	2,600	3,370	3·01	3·47	207,000	D
September	3,900	2,350	3,120	2·78	3·10	186,000	B
October	2,350	1,600	1,980	1·76	2·03	122,000	B
November	1,700	1,350	1,520	1,36	1,32	90,400	B
December, 1912	950	700	825	0·73	0·84	50,700	C
Year	22,000	280	4,000	3·33	48·50	2,899,900	

SPILLIMACHEEN RIVER.

Location.—The gauging section is located just outside the Railway Belt, about two miles from Spillimacheen Landing on the highway on road up the Spillimacheen valley.

Records Available.—June to October, 1912; June to November, 1913.

Winter Conditions.—The winter conditions in this district are severe (-40 °F.) with heavy snowfall. The river is generally frozen from November to April.

Gauge.—A vertical staff gauge is used and read two or three times a week by J. Montgomery.

Channel.—The channel is straight above and below the section for 50 yards. The control is a gravel bar, and there is a pronounced riffle at low water 25 yards below the section.

Discharge Measurements.—Measurements are made from the downstream side of the highway bridge. In 1912, six measurements were made, and in 1913, eight were made.

Accuracy.—The gauge readings are infrequent, the measuring section is good, there is a possibility of backwater from the Columbia during high water, these results should be within 10 per cent.

Discharge Measurements of Spillimacheen River near Spillimacheen Landing 1912–13.

Date.	Hydrographer.	Meter No	Width.	Area of section.	Mean Velocity.	Gauge Height.	Discharge
1912.			Feet.	Sq. ft	Ft. per sec.	Feet.	Sec.-ft.
May 31	H. C. Hughes	1055	119	464	2·43	1·30	1,120
June 17	"	1055	122	585	4·70	2·20	2,740
June 19	"	1055	124	620	5·52	2·55	3,450
July 6	"	1055	122	568	4·18	2·25	2,750
July 19	"	1055	124	599	5·08	2·35	3,040
Sept. 29	C. E. Richardson	1055	114	381	1·45	0·42	554
1913.							
May 20	J. A. Elliott	1672	117	466	2·60	1·17	1,210
June 25	"	1672	123	608	7·39	2·75	4,420
July 11	C. E. Richardson	1048	123	570	6·60	2·60	3,880
July 27	J. A. Elliott	1672	124	613	6·60	2·57	4,070
July 30	"	1672	122	571	4·70	2·10	2,710
Sept. 3	C. E. R and R. G. S.	1048	118	490	3·12	1·50	1,530
Sept. 14	J. A. Elliott	1672	119	488	3·58	1·57	1,750
Nov 26	C. E. Webb	1048	114	330	1·14	0·25	378

Monthly Discharge of Spillimacheen River near Mouth for 1913.

(Drainage area, 580 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage. area.	Total in Acre-feet.
May	5,130*	1,330	1,916	3·30	3·81	118,000
June	8,000	3,680	5,176	8·92	9·95	308,000
July	5,760	2,270	3,813	6·57	7·57	234,000
August	4,520	1,450	2,925	5·04	5·81	180,000
September	2,700	1,000	1,730	2·98	3·33	103,000
October	1,100	505	822	1·42	1·64	50,500
November	575	380	427	0·73	0·81	25,400

Note.—* May estimated from half month's records.

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Daily Gauge Heights and Discharges of Spillimacheen River near Spillimacheen for 1913.

Day.	May.		June.	
	Gauge Height	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	Estimated mean G. H. = 1·0 for 20 days.	Estimated Discharge = 20,000.	3·1	5,440
2			3·3	6,080
3			3·3	6,080
4			3·2	5,760
5			3·0	5,130
6			2·9	4,820
7			3·0	5,130
8			3·2	5,760
9			3·5	6,630
10			3·7	7,310
11			3·9	8,000
12			3·6	6,970
13			3·3	6,080
14			3·0	5,130
15			2·8	4,520
16			2·6	3,950
17			2·6	3,950
18			2·5	3,680
19			2·7	4,230
20			2·8	4,520
21	1·3	1,330	2·9	4,820
22	1·7	1,890	2·9	4,820
23	2·0	2,480	2·9	4,820
24	2·0	2,480	2·8	4,520
25	2·4	3,420	2·8	4,520
26	2·6	3,950	2·8	4,520
27	2·7	4,230	2·8	4,520
28	2·8	4,520	2·8	4,520
29	2·9	4,820	2·8	4,520
30	3·0	5,130	2·8	4,520
31	3·0	5,130	..	..

DAILY GAUGE HEIGHTS AND DISCHARGES of Spillimacheen River near Spillimacheen for 1913.—*Continued.*

DAY.	July.		August.		September.		October.		November.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·7	4,230	2·3	3,170	2·0	2,480	1·0	1,000	0·5	575
2	2·7	4,230	2·5	3,680	1·7	1,890	1·1	1,100	0·4	505
3	2·6	3,950	2·6	3,950	1·4	1,450	1·0	1,000	0·3	440
4	2·5	3,680	2·7	4,230	1·7	1,890	1·0	1,000	0·4	505
5	2·4	3,420	2·7	4,230	1·9	2,270	1·0	1,000	0·4	505
6	2·8	4,520	2·8	4,520	2·1	2,700	1·0	1,000	0·4	505
8	3·2	5,760	2·6	3,950	2·0	2,480	1·0	1,000	0·3	440
9	2·8	4,520	2·5	3,680	1·9	2,270	1·0	1,000	0·3	440
9	2·9	4,820	2·4	3,420	1·8	2,070	1·0	1,000	0·3	440
10	2·9	4,820	2·4	3,420	1·7	1,890	1·0	1,000	0·3	440
11	2·7	4,230	2·4	3,420	1·7	1,890	1·0	1,000	0·3	440
12	2·5	3,680	2·4	3,420	1·7	1,890	1·0	1,000	0·3	440
13	2·4	3,420	2·4	3,420	1·8	1,070	1·0	1,000	0·3	440
14	2·3	3,170	2·1	2,700	1·7	1,890	1·0	1,000	0·3	440
15	2·1	2,700	1·9	2,270	1·7	1,890	1·0	1,000	0·3	440
16	2·0	2,480	1·6	1,730	1·7	1,890	1·0	1,000	0·3	440
17	2·0	2,480	1·6	1,730	1·7	1,890	0·7	730	0·3	440
18	2·0	2,480	1·5	1,580	2·1	2,700	0·7	730	0·2	380
19	2·3	3,170	1·5	1,580	1·7	1,890	0·7	730	0·2	380
20	2·6	3,950	1·4	1,450	1·5	1,580	0·6	650	0·2	380
21	2·7	4,230	1·7	1,890	1·3	1,330	0·6	650	0·2	380
22	2·8	4,520	2·0	2,480	1·2	1,210	0·6	650	0·2	380
23	3·0	5,130	2·2	2,930	1·1	1,100	0·6	650	0·2	380
24	2·9	4,820	2·1	2,700	1·1	1,100	0·6	650	0·2	380
25	2·9	4,820	2·1	2,700	1·1	1,100	0·5	575	0·2	380
26	2·7	4,230	2·1	2,700	1·1	1,100	0·5	575	0·2	380
27	2·5	3,680	2·1	2,700	1·0	1,000	0·5	575	0·2	380
28	2·3	3,170	2·1	2,700	1·0	1,000	0·5	575	0·2	380
29	2·1	2,700	2·1	2,700	1·0	1,000	0·5	575	0·2	380
30	1·9	2,270	2·1	2,700	1·0	1,000	0·5	575	0·2	380
31	2·2	2,930	2·2	2,930	.....	.....	0·4	505	.....	.....

TOBY CREEK.

Location.—One and one half miles from Athalmer, one mile from mouth, on highway bridge on road from Athalmer to Wilmer.

Records Available.—June to September, 1912; May to October, 1913.

Winter Conditions.—The winter conditions are severe in this district, the snowfall is light, as in all semi-arid districts in British Columbia. The river is generally frozen over from November to April.

Gauge.—A vertical staff gauge is used and read by Mr. A. L. Peters, Cyderdale Ranch, Wilmer.

Channel.—The section is not at all suitable for metering, but is the only one available without erecting a cable station, the channel is not straight and the bed is shifting. The water is not at right angles to the bridge and is swift.

Discharge Measurements.—Five measurements were taken in 1912, and nine in 1913, from the highway bridge. These measurements are not reliable.

Accuracy.—The gauge readings are good, the measurements are not reliable; there is a possibility of backwater from the Columbia. Accuracy 20 per cent (guaranteed), but probably within 10 per cent.

SESSIONAL PAPER No. 25f

Discharge Measurements of Toby Creek near Athalmer, 1912, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 28	C. E. R. & H. C. H.	1,055	168	359	2·22	2·00	797
June 29	H. C. Hughes	1,055	167	397	2·80	2·48	1,110
June 14	"	1,055	167	423	3·00	2·60	1,270
July 23	"	1,055	167	378	3·03	2·25	1,140
Sept. 28	C. E. Richardson	1,055	160	122	2·27	0·46	[1]270
1913.							
May 17	J. A. Elliott	1,672	168	202	2·10	1·70	[2]424
June 2	do	1,048	175	616	4·30	3·74	2,650
June 20	do	1,672	173	578	4·20	3·78	[3]2,420
July 11	C. E. Richardson	1,048	170	440	3·50	3·20	1,560
July 25	J. A. Elliott	1,672	170	418	4·42	3·22	1,850
July 30	do	1,672	170	324	3·36	2·60	1,090
Sept. 3	C. E. R. & R. G. Swan	1,048	160	246	2·46	2·20	644
Sept. 13	J. A. Elliott	1,672	158	231	2·93	2·20	[3]676
Nov. 27	C. E. Webb	1,048					[4]140

Note.—[1]Different section.
[2]New gauge.
[3]Different section.
[4]Ice conditions.

Monthly Discharge of Toby Creek near Mouth (highway bridge) for 1913.

(Drainage area, 220 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May[1]	2,290	295	726	3·30	3·81	44,600
June	3,650	1,200	2,133	9·70	10·82	126,700
July	2,470	690	1,487	6·76	7·79	91,000
August	1,960	690	1,230	5·59	6·45	75,600
September	1,530	415	713	3·24	3·62	42,400
October	555	395	441	2·00	2·31	27,100

Note.—[1]First 17 days estimated.

Daily Gauge Heights and Discharges of Toby Creek near Mouth for 1913.

Day.	May.		June.		July.		August.		September.		October.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			3·55	2,205	3·55	1,885	3·2	1,670	2·7	1,100	1·9	495
2			3·65	2,380	3·3	1,810	3·2	1,670	2·3	765	2·0	555
3			3·8	2,660	2·95	1,355	3·2	1,670	2·3	765	1·9	495
4			3·7	2,470	3·0	1,410	3·4	1,960	2·3	765	1·9	495
5			3·5	2,120	2·9	1,300	3·2	1,670	3·1	1,530	1·9	495
6			3·4	1,960	3·0	1,410	3·2	1,670	2·55	965	1·85	470
7			3·5	2,120	3·4	1,960	3·2	1,670	2·35	800	1·85	470
8			4·2	3,450	3·25	1,740	3·15	1,600	2·3	765	1·85	470
9			4·3	3,650	3·2	1,670	3·1	1,530	2·4	840	1·85	470
10			4·3	3,650	3·2	1,670	3·1	1,530	2·2	690	1·85	470
11			3·9	2,850	3·1	1,530	2·9	1,300	2·0	555	1·85	470
12			3·95	2,950	3·2	1,670	3·0	1,410	1·8	445	1·9	495
13			4·0	3,050	2·6	1,010	2·8	1,200	2·2	690	1·95	525
14			3·4	1,960	2·5	920	2·6	1,010	2·1	620	1·9	495
15			3·0	1,410	2·2	690	2·5	920	2·0	555	1·8	445
16			2·95	1,355	2·4	840	2·3	765	2·0	555	1·8	445
17			2·8	1,200	2·4	840	2·3	765	2·2	690	1·7	395
18	1·7	395	2·8	1,200	2·6	1,010	2·3	765	2·7	1,100	1·7	395
19	1·7	395	3·5	2,120	3·05	1,470	2·2	690	2·2	690	1·7	395
20	1·75	420	3·4	1,960	3·2	1,670	2·2	690	2·2	690	1·7	395
21	1·9	495	3·2	1,670	3·2	1,670	2·3	765	2·2	690	1·7	395
22	2·2	690	3·15	1,600	3·45	2,040	2·6	1,010	2·2	690	1·7	395
23	2·5	920	3·2	1,670	3·7	2,470	2·6	1,010	2·0	555	1·7	395
24	2·6	1,010	3·2	1,670	3·5	2,120	2·9	1,300	2·0	555	1·7	395
25	2·8	1,200	3·25	1,740	3·2	1,670	2·85	1,250	2·0	555	1·7	395
26	3·0	1,410	3·4	1,960	3·1	1,530	2·7	1,100	2·0	555	1·7	395
27	3·3	1,810	3·3	1,810	3·1	1,530	2·5	920	2·0	555	1·7	395
28	3·45	2,040	3·2	1,670	3·0	1,410	2·7	1,100	2·0	555	1·7	395
29	3·45	2,040	3·2	1,670	2·9	1,300	2·9	1,300	2·0	555	1·7	395
30	3·6	2,290	3·3	1,810	2·9	1,300	2·7	1,100	2·0	555	1·7	395
31	3·6	2,290			2·8	1,200	2·7	1,100			1·7	395

YOHO RIVER.

General.—There is no regular gauging station on Yoho river. The discharges are deduced from the discharges of Kicking Horse river, above and below the mouth of the Yoho i.e. near No. 2 tunnel, and near Field.

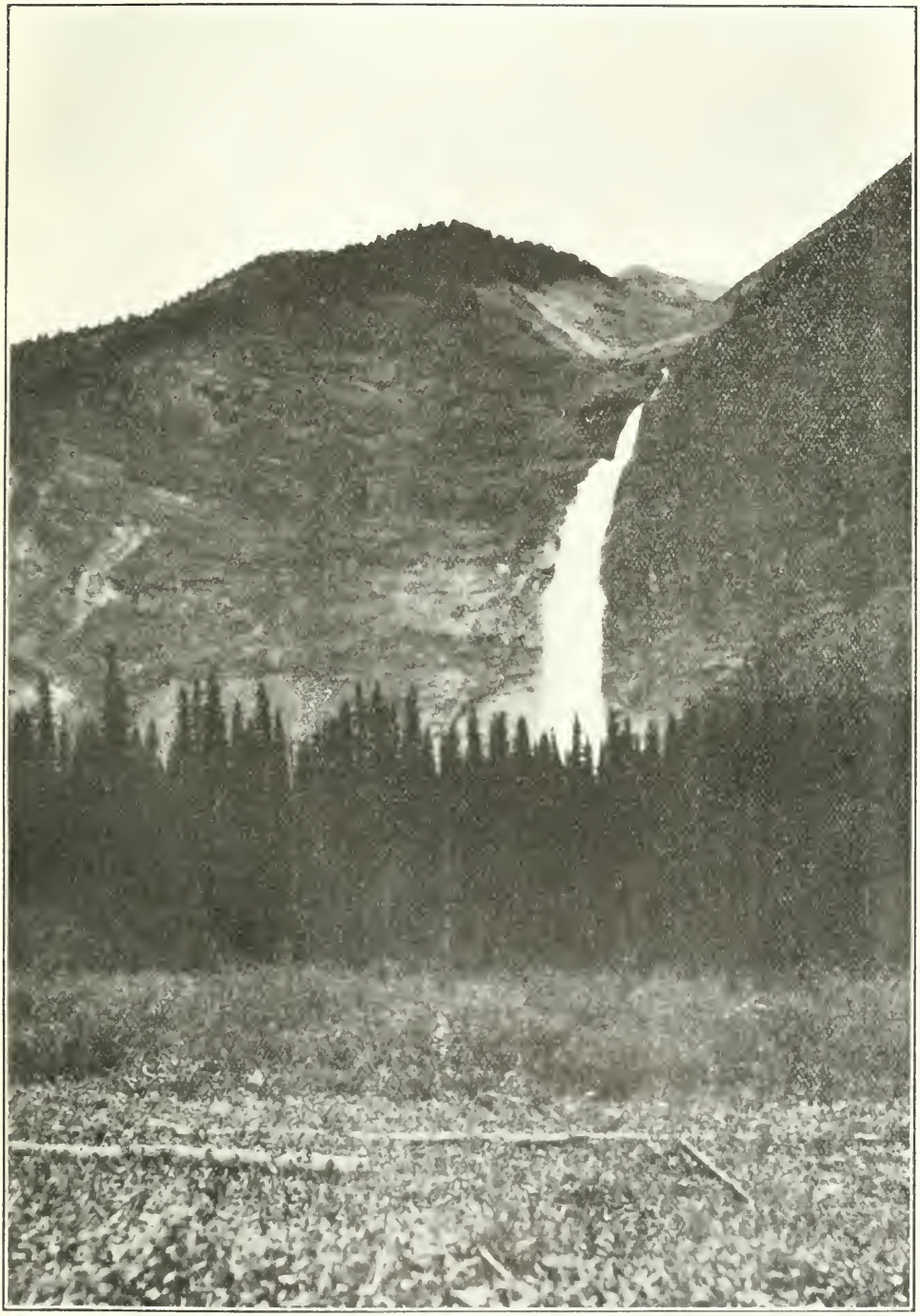
Winter Conditions.—The winter conditions are very severe in the Yoho drainage, the thermometer dropping as low as -50 °F.. The snowfall is very heavy, particularly in the upper reaches. The river remains frozen for three or four months each year.

Monthly Discharge of Yoho River at Mouth for 1913.

(Drainage area, 75 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
June	2,140	548	1,260	16·8	18·7	74,500
July	2,580	493	1,530	20·4	23·5	94,100
August	2,520	606	1,610	21·4	24·7	99,000
September	770	160	342	4·6	5·1	20,400
October	191	73	103	1·4	1·6	6,330
November	82	62	74	1·0	1·1	4,400

Note.—Discharges deduced from discharges obtained on Kicking Horse river above and below mouth of Yoho river.



Takakkaw Falls—Yoho Valley near Field, B.C.

DAILY DISCHARGES of Yoho River near Field for 1913.

DAY.	June.	July.	August.	September.	October.	November.
	Discharge.	Discharge.	Discharge.	Discharge.	Discharge.	Discharge.
	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.
1	919	1,771	2,088	668	191	73
2	1,033	1,404	2,045	755	159	82
3	1,219	1,059	2,149	770	139	82
4	1,219	1,105	2,519	568	131	82
5	1,059	987	2,329	559	116	82
6	1,014	1,288	2,149	668	111	82
7	1,314	2,034	1,977	688	112	82
8	1,539	1,954	1,771	511	112	82
9	1,683	1,679	1,679	388	108	82
10	2,136	1,611	1,702	318	108	82
11	1,910	1,474	1,885	390	108	82
12	1,866	1,105	2,149	330	98	82
13	1,747	878	1,833	280	98	82
14	1,425	688	1,474	213	98	72
15	1,014	493	1,082	245	83	72
16	715	511	857	245	93	72
17	548	528	778	220	93	72
18	918	918	778	205	93	72
19	1,405	1,288	688	175	93	72
20	1,745	1,679	606	175	93	72
21	1,379	2,058	706	160	93	62
22	1,337	2,009	936	160	93	62
23	1,059	2,034	1,666	175	103	62
24	1,059	2,428	1,968	190	103	62
25	1,059	2,584	1,948	190	88	62
26	897	2,451	1,948	204	88	62
27	812	2,127	1,768	204	88	70
28	1,105	2,022	1,648	204	88	70
29	1,222	1,565	1,648	204	88	70
30	1,359	1,768	1,788	204	73	70
31	.....	1,968	1,328	.....	73	.....

MISCELLANEOUS METERING STATIONS.

INCOMAPPLEUX RIVER.

Location.—Immediately outside the Southern limit of the Railway Belt 2 miles from the mouth near Beaton, on the Northeast Arm, Arrow Lakes.

Winter Conditions.—The snowfall is heavy but the temperature (-30 °F.) is milder than at Revelstoke, the river freezes over for two or three months each year.

Gauge.—Due to a probable effect of backwater, the gauge could not be located on the bridge between Commapleux and Beaton, from which measurements are made. A staff gauge was established near Burbidge's ranch in May but due to excessive highwater and drift wood it was washed out in June. A new gauge was set in a slightly different location and tied into same bench marks. This gauge was found to be in riffle in low water, and a third gauge was set. No relation could be obtained between the three gauges.

Channel.—At the gauge the water is fast, the control has not been studied, the measuring section is satisfactory.

Discharge Measurements.—Seven well distributed measurements were obtained in 1913.

Accuracy.—Due to great trouble with the gauge reliable daily discharges were not obtained, so the results are not published. The Incomappleux and

Illecillewaet appear to be similar streams. The drainage areas are about the same, but the discharge of the Incomappleux during the summer months appears about 30 per cent in excess of the Illicillewaet. During the winter it appears to fall lower than the Illecillewaet.

Discharge Measurements of Incomappleux River near Beaton for 1913.

1913.		Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 8.....	C. E. R. & J. A. E.	1,048	100	635	2·80	2·28	1,800
" 28.....	J. A. E.....	1,672	96	1,130	7·63	4·90	[1]8,632
July 8.....	J. A. E.....	1,672	98	966	6·16	5·50	5,932
" 18.....	J. A. E.....	1,672	100	1,056	5·82	5·02	6,130
Aug. 11.....	J. A. E.....	1,672	90	1,097	5·39	5·60	5,940
Sept. 18.....	R. G. S. & C. E. R.	1,048	98	830	4·91	4·87	4,080
Nov. 21.....	C. E. W.....	1,048	93	526	1·13	2·40	597

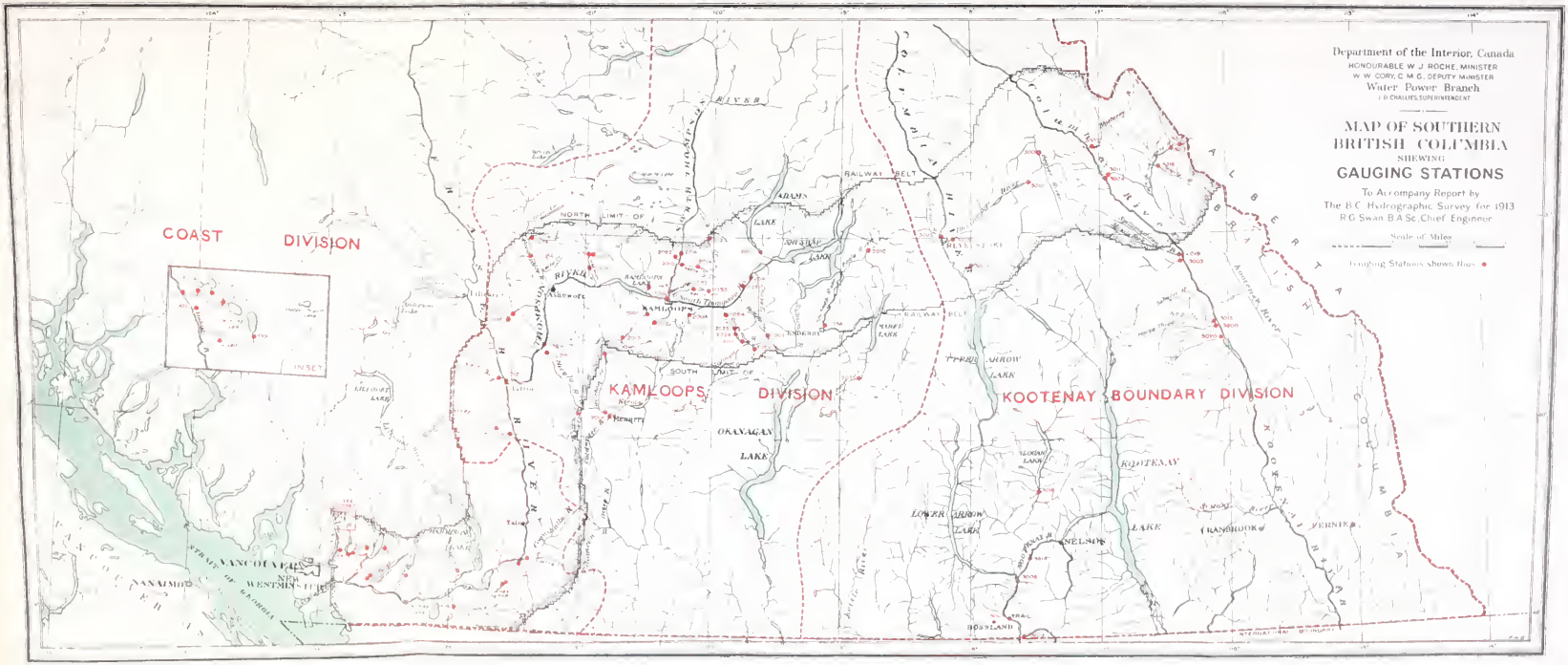
Note.—[1]Fair measurement.

Monthly Discharge of Columbia River at International Boundary Line for 1913.

(Drainage area, 61,000 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
June...	428,000	279,000	368,000	6·03	6·73	21,900,000
July..	329,000	186,000	241,000	3·95	4·55	14,800,000
August...	184,000	113,000	146,000	2·39	2·76	8,980,000
September	112,000	70,700	94,600	1·55	1·73	5,630,000
October....	68,800	47,200	54,800	0·90	1·04	3,370,000
November	47,400	37,100	41,000	0·67	0·75	2,440,000
December..	37,600	24,800	30,400	0·50	0·58	1,870,000

Note.—Deduced by adding discharges of Pend d'Oreille and Columbia at Trail.


Department of the Interior, Canada
HONOURABLE W J ROCHE, MINISTER
W W CORY, C M G, DEPUTY MINISTER
Water Power Branch
J B CHALLIES, SUPERINTENDENT
MAP OF SOUTHERN BRITISH COLUMBIA
SHEWING
GAUGING STATIONS
To Accompany Report by
The B C Hydrographic Survey for 1913
R G Swan B A Sc, Chief Engineer
Scale of Miles
Gauging Stations shown thus
COAST DIVISION
INSET
KAMLOOPS DIVISION
KOOTENAY BOUNDARY DIVISION
NORTH LIMIT OF RAILWAY BELT
SOUTH LIMIT OF RAILWAY BELT
FRASER RIVER
THOMPSON RIVER
NORTH THOMPSON RIVER
SOUTH THOMPSON RIVER
KAMLOOPS
OKANAGAN LAKE
KOOTENAY
KOOTENAY LAKE
KOOTENAY RIVER
ARROW LAKES
UPPER ARROW LAKE
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